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and
AIRCRAFT ENGINEER

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The Outlook

The Human Factor

IN an article published in our issue of May 1st, 1947, a contributor who signed himself "Vertigo" drew attention to the serious risk we are running in overlooking the psychological reactions of what he termed "the link between the dashboard and the controls" (the pilot), to the maze of instruments, knobs and levers with which the cockpit of the modern flying machine is filled to overflowing. As he pointed out, "time and motion studies have been carried out on housewives cooking meals to determine the best design for the modern kitchen. But has anyone ever thought of doing the same thing in the cockpit, so that at least all the vital controls are arranged in the proper sequence, and in the correct sense, for natural and efficient action?"

The obvious retort to that question is another: what is natural action? In what the French used to term the "heroic" days of flying there was much controversy about the three flying-controls. In the monoplanes designed by M. Nieuport in about 1911 the wing-warping (used on many early machines instead of ailerons) was done by the feet. M. Nieuport argued that it was natural for the pilot to "press down" the wing by stepping hard on a footbar. The system did not become general, and the present one has become universally accepted but for a few two-control types of aircraft.

In those days the flying-controls were pretty well all the pilot had in the cockpit. The health or otherwise of the engine was judged by ear, the speed largely by the draught on the pilot's face, and as for navigation, well, there was generally the sun, since little flying was done in bad weather.

Things have changed since then, and scores of "gadgets" have been interposed between the pilot and his machine. But it is to be feared that all this gadgetry has grown and multiplied along somewhat haphazard lines, and that the pilot's psychology has not been given the consideration it deserves. To quote "Vertigo" again: "Who knows whether there is something wrong somewhere, whether we are asking the brain to perform some function so foreign to it that, with all the marvellous devices in the world, the poor old human donkey may not let us down in the end?"

In America they have been making an extensive study of this question, and in this issue we publish extracts from and comments on the results obtained by the American Aero Medical Laboratory at Wright Field. They make interesting reading.

Probing the Problems

GREAT changes have taken place since plans were made for an International Air Congress to be held in England in 1940. That congress came to naught because of the war, but the programme that was mapped out in 1939 was a fairly ambitious one. For one thing, the Royal Aeronautical Society had chosen Stratford-on-Avon as a fitting scene for the event, and in addition to the reading of numerous technical papers there were to be many social entertainments, including luncheon parties, visits to places of historical interest, a garden party, a ball, and two banquets.

Science is fundamentally international, and there is little doubt that if the 1940 congress had been held, many interesting technical subjects would have been ventilated, probably including papers by German, French and certainly American lecturers. The Anglo-American Conference which the Royal Aeronautical Society has organized for September 3rd to 6th this year is a good deal less ambitious. For one thing, the present scarcity of almost everything has necessitated a curtailment of the social aspect, although this is not being overlooked. For instance, there will be a dinner in London's Guildhall at which many notable people will be present.

From the list of papers to be read by American and British specialists it is evident that in spite of the fact

that the lecturers represent two countries only, the subjects covered will deal with almost every major problem which confronts the aircraft technician at the present time. It is interesting to reflect, and indicative of the vast developments that have taken place since 1939, that even if secrecy considerations had permitted, many of the problems to be debated this year had scarcely arisen at the time the earlier congress was planned. Jet propulsion was little more than the dream of a few visionaries, and the name Whittle was unknown to the world at large.

A subject which does not appear to be covered in the lectures is that of designing airscrews for gas turbines. The article by Mr. L. G. Fairhurst, the second part of which appears in this issue, should therefore prove a valuable complement to the September lectures. Of problems in the design of the gas turbines themselves there are many, and in the past it seems to have been taken for granted that any associated airscrew problems will be taken care of by the airscrew designer. Mr. Fairhurst makes it very clear that there is much work to be done before the turbine-airscrew combination can adequately meet the demands that will be made upon it.

Round the World Again

CAPTAIN ODOM has lowered the time for a solo flight around the world to 73 hours 5 minutes. Just what he has proved thereby is not clear. The reliability of modern aircraft, their engines and equipment is not in doubt—given proper maintenance. The late Wiley Post took some 187 hours to do the circuit (a slightly shorter one), but that was 14 years ago, in a Lockheed Vega with one 450 h.p. engine.

Post had far less aid from navigational facilities, and almost the only piece of equipment common to the *Winnie May* and the *Reynolds Bombshell* is the automatic pilot, which in both cases enabled the human pilot to take occasional short snatches of sleep. Captain Odom's engines had to run for 73 hours only, while Post's kept going for 187. Pilot strain must have been approximately proportional to the length of time taken, so if human endurance is the criterion, Post's was the greater achievement.

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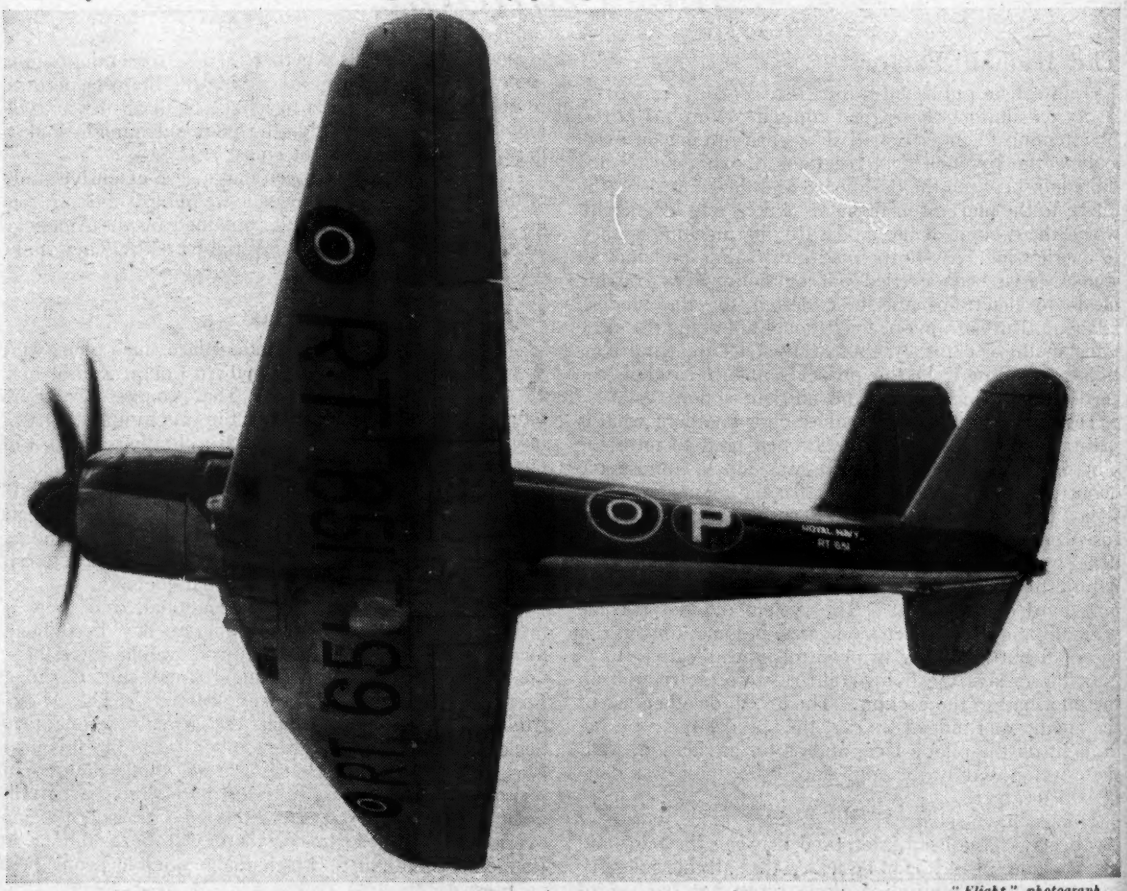


"Flight" photograph.

BREAKAWAY: *One of the first British aircraft designed from the outset as a single-seater deck-landing naval strike aircraft, the Blackburn Y.A.1, unofficially named Firecrest, is seen on test near Brough. The engine is a Bristol Centaurus.*

SHORT-DISTANCE AIDS TO NAVIGATION

Australian Developments in Distance-measuring and Multiple-track Range Equipment

ONE of the greatest problems of civil aviation is that of air traffic control around the major airports. The provision of a really adequate short-distance aid to navigation, to guide the movement of aircraft entering or leaving such airports, would go far towards the solution of the problem. Opinions differ on the exact form such an aid should take, but there is a majority opinion in favour of providing a set of radial tracks along which aircraft can fly, and a continuous measurement of distance to or from the airport. A navigational aid of this type can be described as a polar co-ordinate system with the airport as centre.

It is customary to define the polar co-ordinates by two pieces of equipment, a radar distance indicator and some form of radial track guide or omni-directional radio range. An interesting example has been developed in Australia and is at present undergoing operational trials on the Sydney-to-Melbourne air route. The route is served by three sets of ground stations at Melbourne, Sydney and Yass, as shown in Fig. 1. In a final system there would be a fourth station filling the gap between Melbourne and Yass.

In this system, the polar co-ordinates are obtained by the combination of distance-measuring equipment and a multiple-track range of special characteristics. The distance-measuring equipment gives a measure of the distance, in miles, to any selected radar beacon along the route, while the multiple-track range provides up to sixty tracks, along any one of which the pilot may fly by following a left-right dashboard indicator. Both aids operate on VHF and are, therefore, limited in range to radio line-of-sight, but of course they are unaffected by interference from atmospherics.

The distance-measuring equipment works on well-known radar principles and is a development of the wartime Rebecca-Eureka system, in which a single meter on the dashboard replaces the cathode-ray tube and operator.

The multiple-track range is a development of Gee but, unlike Gee, the ground stations are placed only three to ten

Fig. 2. The temporary distance-measuring equipment beacon at Essendon Airport, Melbourne.

THE work described in this article has been done during a period of nearly two years by the Radiophysics Division of the Australian Council for Scientific and Industrial Research, in collaboration with the Australian Department of Civil Aviation. It is contributed to "Flight" at the special request of Dr. E. G. Bowen, chief of the Radiophysics Division.

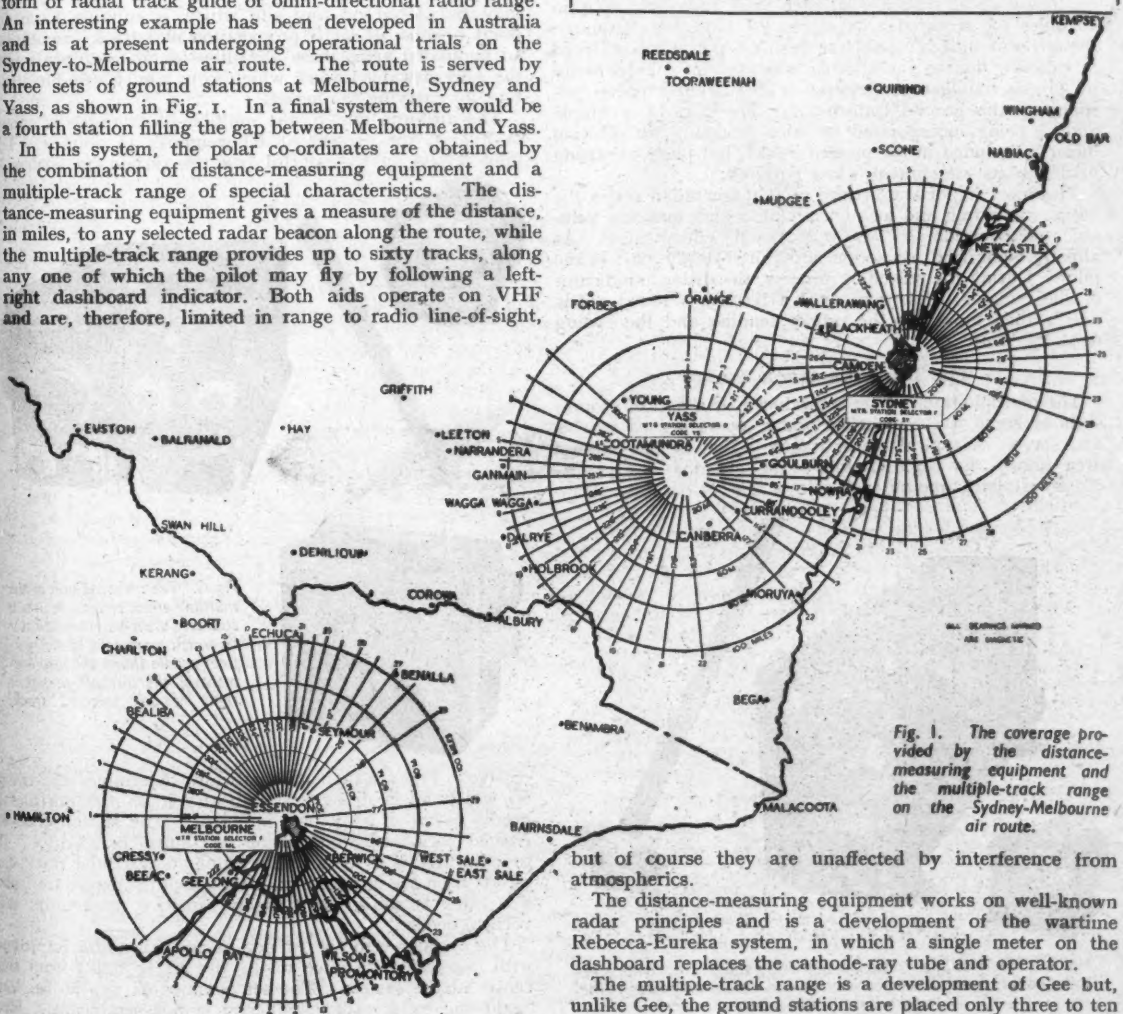


Fig. 1. The coverage provided by the distance-measuring equipment and the multiple-track range on the Sydney-Melbourne air route.

Short-Distance Aids to Navigation . . .

miles apart, producing a set of hyperbolæ which are effectively straight and radial over the operating region. The cathode-ray tube is replaced by a cross-pointer meter giving the pilot his rough position on the horizontal needle and his departure from any selected track on the vertical needle.

The Distance-measuring Equipment

The Australian distance-measuring equipment is shown in Fig. 3. It consists of a spike aerial, a radar transmitter and receiver in a single box, and a dashboard instrument. The weight is 26 pounds. The set is automatic and requires no operation by the pilot. As soon as it is switched on it searches automatically for a beacon and locks on to the nearest one. If the pilot requires a more distant beacon, a touch of the button marked "Release" causes the searching circuits to move along to the next beacon in range. He can verify the identity of the beacon being received by reading the code which flashes periodically on the neon in the left-hand corner of the indicator.

A photograph of a ground beacon is shown in Fig. 2, being the temporary installation at Essendon Airport in Melbourne. The equipment operates on 202 and 222 Mc/s, but there is no special significance in the radio frequency used. Any frequency in the 200 Mc/s band may be chosen.

Two range scales are provided in the airborne unit, 0-120 and 0-12 miles, and the accuracy of measurement is ±2 per cent at distances greater than 12 miles. Within 12 miles the required accuracy is ±¼ mile, but, although the airborne unit is capable of this, it is not being achieved in practice due to the trouble which is invariably found in precise navigation devices—echoes from objects surrounding the ground transmitter. The remedy is simple and is being incorporated in later models. No orbiting meter is included in the present model, but plans are being made for its attachment when required.

The most important feature of the Australian set is the automatic search and lock-on circuit, which makes a valuable contribution to its operational effectiveness. As already mentioned, no action is required on the part of the pilot. During the searching process, the distance-indicator needle remains below zero until a beacon is found. The needle then moves to the proper reading and the coding neon lights up.

The Multiple-track Range

The multiple-track range is produced by a pair of ground stations some 3 to 10 miles apart, operating as master and slave. A typical set of tracks is that in the Sydney area shown in Fig. 4, where the stations are placed 8.9 miles apart, one on each side of Mascot Airport. They

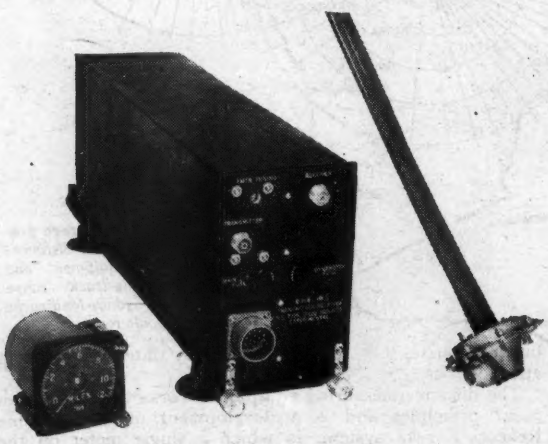


Fig. 3. The Australian distance-measuring equipment, comprising spike aerial, transmitter-receiver unit and dashboard meter. The total weight is 26 pounds.

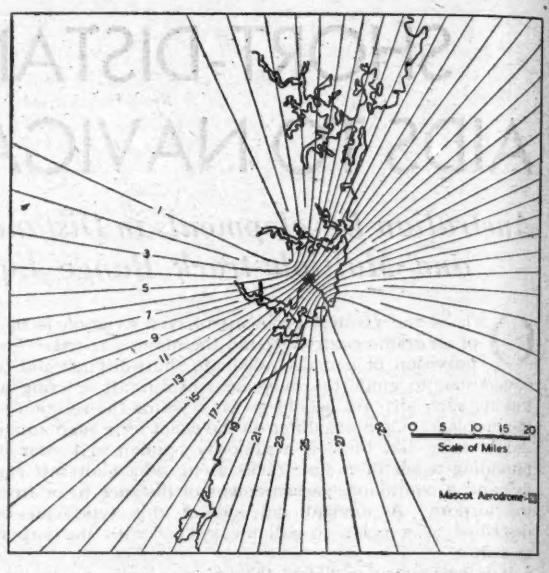


Fig. 4. The multiple-track range tracks around Sydney.

may be placed on any site which is suitable from the point of view of VHF propagation and track orientation. In populated areas these are often found to coincide with the sites of water towers, which form a very suitable structure for carrying the aerials.

The airborne unit of the multiple-track range is shown in Fig. 5, the present model weighing 35 pounds. The pilot selects on the control box the station he wishes to

Fig. 5. The airborne unit of the multiple track range. It uses a standard cross-pointer indicator on which movement of the vertical needle shows the displacement of the aircraft to left or right of any selected track.

receive. The set then automatically determines the track on which he is flying and indicates it on the horizontal needle of the cross-pointer indicator. The station code is flashed periodically on a neon to confirm its identity. If the pilot wishes to fly accurately along a particular track, he selects it on the control box, after which his departure from this track is shown in a highly sensitive manner on the vertical needle.

The angular error is ±1 deg at 100 miles and improves with decreasing distance to ±¼ deg at 10 miles from the centre of the system. The set operates on 212 Mc/s, but again the exact radio frequency is not significant. The

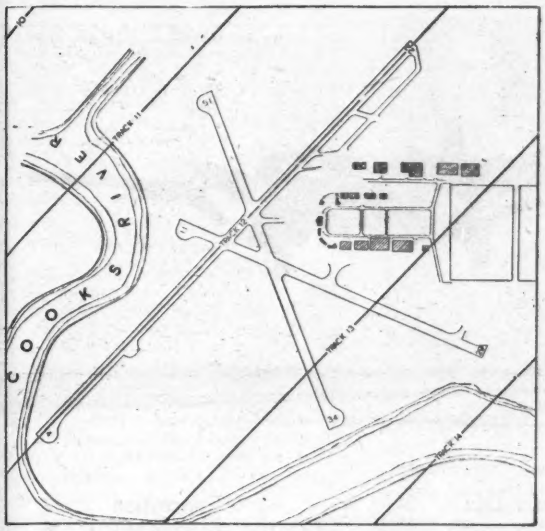


Fig. 6. An enlarged sketch of the tracks crossing the runways at Mascot Airport. Track 12 runs down the main runway, and it is expected that approaches can be made from either end with an accuracy approaching that of existing instrument-landing systems.

range is limited to line-of-sight and is 120 miles at 8,000 feet.

The multiple-track range has features which CW omni-directional ranges, based on phase or amplitude comparison, can never have. The most important of these is its freedom from site errors. The signal used is the first one to arrive, that is the one which travels by the shortest route from the ground station to the aircraft. Any echo signals received from large buildings or hills arrive at a later time and are automatically rejected. They cannot influence the accuracy of the system, and no errors due to siting have been detected in any of the installations which have been made either in city areas like Sydney and Melbourne or in hilly country such as exists around Yass.

On CW systems, echo signals cannot be separated from the main received signal in this way, and they can, therefore, be expected to have quite serious and unpredictable errors due to reflections from surrounding objects. The multiple-track range is already rather more accurate than any CW system, although no real attempt has been made to exploit to the full the inherent accuracy of the pulse method. In other words, CW systems are near the limit of possible accuracy, whereas pulse systems can be improved still further in the near future.

Another very practical advantage of the multiple-track range system is that the ground stations are almost identical with the distance-measuring equipment ground beacons. This is an important consideration from the operator's point of view, since the same spares and maintenance procedures can be used for each. The airborne units are rather more different from one another but the same basic circuits are used in each case. This again can make an important difference to the spares and servicing problem.

Few Drawbacks

There is some objection to the multiple-track range as a method of track guidance because it is not completely omni-directional, having two gaps of 30 deg along the line joining the ground stations. This is not serious in most parts of the world, but where omni-directional cover is essential, it can be supplied by the addition of a third ground station. A second, more serious, objection is that the track numbers bear no relation to compass bearings and vary from one locality to another. This is the price paid for complete freedom in siting the ground stations.

It should be noted that, while the multiple-track range tracks are straight beyond five or ten miles of the centre of the system, they become hyperbolic within this region and pass through the centre as a set of straight, nearly equi-spaced tracks. The accuracy with which any of these can be flown approaches that of the localizer of a landing aid like SCS.51. It therefore provides great possibilities of making instrument-approaches on parallel runways. Its use for this purpose is being investigated in Sydney, the track system in relation to the runways at Mascot being shown in Fig. 6.

The trial route from Sydney to Melbourne has been operating since January of this year, the airborne units being carried in two commercial aircraft, a passenger-carrying Skymaster and a DC-3 freighter. In addition, an aircraft of the Council for Scientific and Industrial Research is being flown for experimental tests, and one belonging to the Department of Civil Aviation is being fitted for the same purpose. The ground stations, comprising one D.M.E. and two M.T.R. sets on each of the three sites, are operated and maintained by one man. Being experimental in character, they do not have remote switching or monitoring facilities. These are gradually being introduced, however, after which the stations will be left unattended.

The installation planning was simple. As an example,

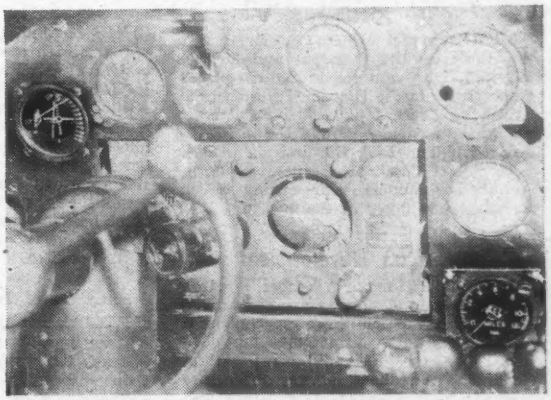


Fig. 7. Installation of the indicators in the Skymaster.

the whole of the Yass system was installed and put into operation by a party of four men in two weeks. The placing of tracks and siting of stations is done almost entirely from maps, and once the stations are erected, the tracks are drawn directly on navigation charts without fear of error.

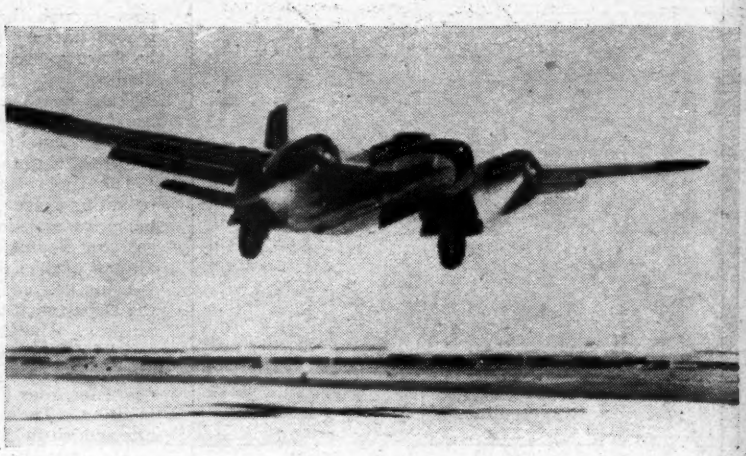
The distance-measuring equipment has been adopted for use on Australian air routes, and installation will proceed as soon as manufactured equipment is available. The multiple-track range will be operated experimentally for a further period on the Sydney-Melbourne route before a decision is made on its future use. One installation also exists in England, where R.A.F. Transport Command is testing it as the track-guide component of their Rapid Landing System.

[*The Australian system was explained to delegates at the P.I.C.A.O. demonstrations in this country last year, and later demonstrated to the delegates in Montreal, when representatives of member nations met to discuss the adoption of an international system for navigation. This system will not be adopted internationally, but we understand the Australian Department of Civil Aviation may provide chains for the use of civil airlines throughout Australia.*—ED.]

FORTHCOMING EVENTS

Aug. 16th.—Strathtay Aero Club : Perth air display.
Aug. 20th to 29th.—Twenty-Second Model Engineer Exhibition. New Royal Horticultural Hall, Vincent Sq., S.W.1.
Aug. 22nd to 25th.—Norwegian Aero Club : Air rally, Tönsberg, near Oslo
Aug. 28th to Sept. 13th.—Engineering and Marine exhibition. Olympia London.
Aug. 30th and 31st.—Cinque Ports Flying Club. Folkestone Air Races meeting. Lympne airport.
Sept. 3rd to 6th.—Royal Aeronautical Society : Aeronautical Congress.
Sept. 6th.—Naval Aviation : Air display and static exhibition. Lossiemouth air station, Moray, Scotland.
Sept. 6th.—Air Display at R.N.A.S. Yeovilton.

HERE AND THERE



RECORD BREAKER: The converted Douglas A26, "Reynolds Bombshell" takes off from Chicago on the first stage of its round-the-world record flight. Capt. Odom was in the air for 63 hours 15 minutes. (See story on page 169).

English Modellers' Win

PROUD model owners are Mr. C. T. Buffery, Mr. J. Blunt and Mr. J. Wreford, who won the first three places respectively in the Bowden International Trophy for model power-driven aircraft at Fairlop airfield on August Bank Holiday. England took the first six places, with M. Fillon, of France, seventh. About 150 models, representing seven nations, were flown at the meeting.

American Development

SOME indications of American research have been given by General Vandenberg, in an article in a special issue of *Pegasus*, an aviation magazine published by the Fairchild Corporation. General Vandenberg states, "We are now conducting extensive research and development activities in the field of guided missiles and associated equipment, and corresponding countermeasures. We have begun, in collaboration with the Atomic Energy Commission and private industry, an investigation of possible applications of nuclear energy in offensive and defensive weapons, and in the propulsion of aircraft. Great emphasis is being given to the development of supersonic aircraft.

Forty Years Old

THE beginning of this month marked the 40th anniversary of the American Army Air Forces, and to celebrate it in London Maj. Gen. Clayton Bissell, Military and Air Attaché to the American Embassy, held a garden party for 350 guests, including many from the Service. On August 11th, 1907, the date on which the American Aeronautical Division was established, the Air Force comprised three balloons and a handful of men. In 1944 its peak was 80,000 aircraft and 2,412,000 men.

The King's Mail

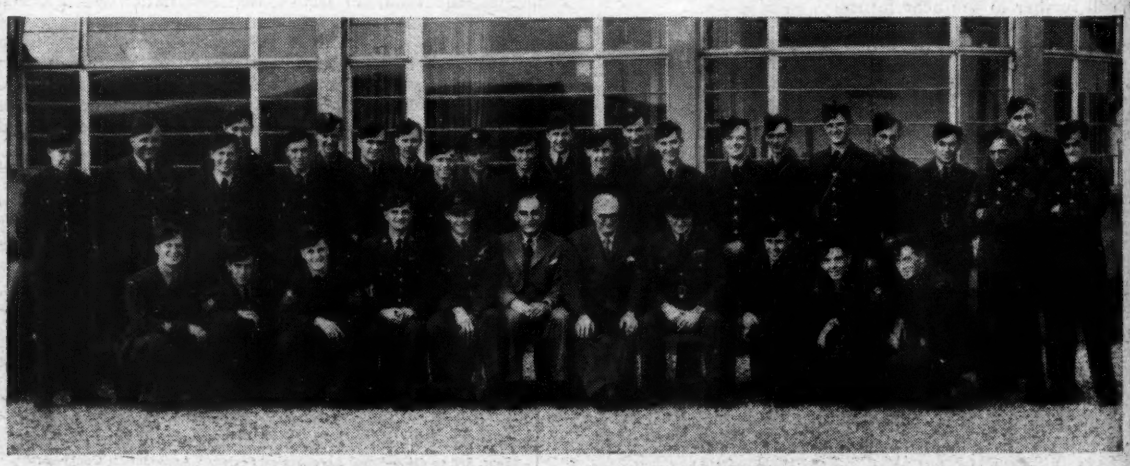
SPECIAL arrangements have been made for important Court and official mail to reach the Royal family quickly during their stay at Balmoral. Each day a Viking takes off from London and flies mail to Dyce. From there the mail travels via helicopter almost to the door of Balmoral, and a return service is operated the same day. It is believed that this is the first scheduled air-mail helicopter service to be operated in this country. It might well prove to be the forerunner of more extensive helicopter postal activities, especially in view of the fact that B.E.A. are to take delivery of five helicopters by the end of this year.

Concession

HONORARY membership of the Cinque Ports Flying Club, for the two days of the forthcoming International Flying Meeting at Lympne on August 30th and 31st, 1947, is open to members and associate members of the Royal Aero Club at a fee of five shillings. This special concession will entitle the holder to the use of the Members' Enclosure and the usual club facilities, as well as car passes at the reduced price of five shillings. Hotel accommodation, which is limited, may be booked on application to the secretary-general of the Royal Aero Club, at the Aviation Centre, Londonderry House, Park Lane, London, W.1, to whom application should also be made for the honorary membership and car pass tickets.

World Buying British

MR. JOHN WILMOT, Minister of Supply, revealed recently that the total value of British exports of aircraft and equipment for the first five months of this year was more than £7,250,000, and the estimate for the whole year was £20,000,000. About a third of the total went to hard-currency countries. Deploring the tendency of some people to deprecate British civil aircraft and



SEEING BRITAIN: 23 of the R.C.A.F. cadets who are on an "exchange" visit to this country recently visited the Blackburn Aircraft Co., where they made a tour of the factory and saw a demonstration of the Firebrand Mk V. Seated in the centre of the group are (R.) Mr. Robert Blackburn, chairman and joint managing director, and (L.) Capt. N. W. G. Blackburn, director.

Here and There . . . . .

engines, Mr. Wilmot pointed out that the Americans had paid us the great compliment of buying the manufacturing licences for Rolls-Royce Derwent and Nene jet engines, and he said, "I understand that the U.S. Navy intend to install the Nene in their new Grumman fighter."

Exchange

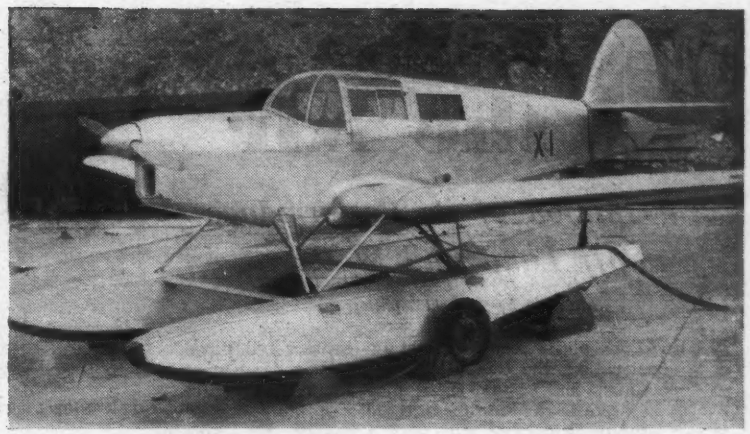
THE British aircraft carrier H.M.S. *Venerable*, of 14,000 tons, is to become the property of the Dutch Navy. She is to replace the 14,000-ton escort carrier *Karel Doorman*, which has been on loan to the Dutch Navy since 1945, and which will be returned to Britain next March. H.M.S. *Venerable* is designed to carry thirty-six aircraft, has a speed of 25 knots, and an overall length of 694ft. The Dutch Navy is at present being equipped with Mk. IV Fairey Fireflies.

Soviet Show

RUSSIA'S iron curtain was lifted partially last week when the Soviet Union celebrated its "aviation day." During a mass air display over Moscow, jet aircraft of six different types, including Yakoloev fighters, were seen in public for the first time. One fighter is reported as having a standard piston engine with jet "boosters," enabling it to make an almost vertical climb. Col. Gen. Studets, Chief of Staff of the Soviet Air Force, said that Marshal Stalin had set Russians the task of "flying farther, faster and higher than anyone."

Flying Telegrams

PASSENGERS flying with Trans-Australia Airlines will soon be able to send telegrams to their friends on the ground. Tests carried out recently have proved successful, and an air-radiogram service is to be introduced shortly. B.O.A.C. reintroduced a similar service during January of this year, after it had been discontinued owing to the war.



ON FLOATS: Above is one of the Percival Proctors which has recently been fitted with floats for experimental flight trials, as reported in "Flight" last week. It is equipped with a Gipsy Queen engine and Edo floats.

Australian Visit

LORD NATHAN, Minister of Civil Aviation, who headed the British Mission to the South Pacific Air Transport Council at Canberra, arrived at Sydney last week in a B.O.A.C. Lancastrian. The official party was met at Sydney airport by Mr. Drakeford, the Australian Air Minister, the Rt. Hon. E. J. Williams, British High Commissioner, representatives of the New South Wales Government and the Sydney Civil Authorities, and Mr. Hudson Fysh.

Show Boat

THE 20,000-ton aircraft carrier *Albatross* that was part of the invasion armada, has become a floating hotel. Now owned by the South-Western Steam Navigation Company, she has been converted into a modern show-boat with her hangar as a huge ballroom. It is planned to anchor the carrier off Torquay and carry visitors to her in motor boats.

ROYAL VISIT: Her Majesty the Queen made her first visit to London Airport, Heathrow, last week, when she flew from Yorkshire in one of the Viking aircraft of the King's Flight. After talking to members of the crew and airport officials, the Queen left by car for Windsor.

News in Brief

A discussion on the "Structural Design of Wings" will be held at the Royal Aeronautical Society, 4, Hamilton Place, W.1, at 7.30 p.m. on Tuesday, September 23rd. The discussion will be introduced by Mr. F. Tyson, A.F.R.Ae.S., assistant chief stressman, Handley Page Ltd.

* * *

The second reunion of the ex-permanent staff of No. 28 E.F.T.S., Mount Hampden, Southern Rhodesia, is to be held on Saturday, September 6th, at the headquarters of the Redhill Flying Club, Redhill airfield, Surrey. Enquiries should be addressed to Mr. C. Nepean Bishop, Redhill Flying Club.

* * *

General Dornberger, former chief of the German V2 research station at Peenemünde, who was in a prison camp at Bridgend, Glamorgan, has been flown to the U.S. to help American scientists. Before leaving for America he was allowed to visit Germany.

* * *

D.D.L. have now taken delivery of their fifth Vickers Viking, OY-DLU "Torlak" It arrived at Copenhagen recently.

* * *

A war-time Dakota has been converted for Dalmia Jain Airways, Ltd. of India, at the Nottingham works of Tollerton Aircraft Services, a subsidiary of Field Aircraft Services, Ltd., of Croydon. The aircraft will leave for India shortly.

* * *

Purchase of a Fiat G.55 aircraft from Italy has been made by the Argentine government. The aircraft has been delivered and was demonstrated last month by a group of Fiat technicians to members of the Secretariat for Air and other government officials.

* * *

Sharnbrook, population 750, is one of three rural villages near Bedford which are to be enlarged to accommodate the staff of the new National Aeronautical Establishment which is to be built on the outskirts of the town. Cost of the research station is estimated at twenty million pounds.

Seabee in the Air

An Opinion of its Performance Off Land and Water

Illustrated by "Flight" photographs

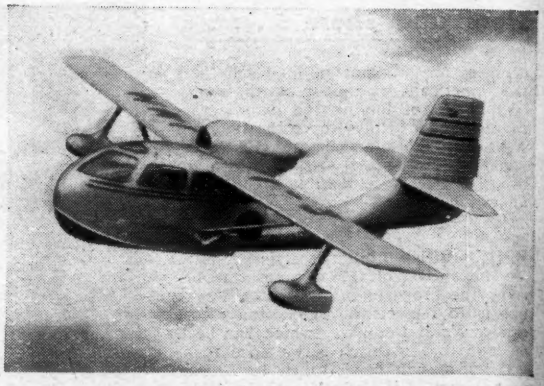
BECAUSE of its many interesting features and novel construction, the Republic Seabee has justified more comment in *Flight* than most light four-seater American aircraft. At the time of the description published in our issue of September 5th, 1946, I had not been able to arrange to fly the Seabee as pilot, but had examined the embryo production lines and some of the first machines to be built at Farmingdale, the Republic aviation plant on Long Island.

At that time the unusual simplified construction, the enormous output planned, and the very low production costs of airframe and engine were all "eye-openers" in this country. Figures of 3,500 aircraft in the first year and a run of 5,000 were anticipated by the Corporation. It now seems that the Seabee was one of the chief victims of over-selling in the American light aircraft world, that the assessors employed by the Republic Corp. took an over-rosy view of the market, and that, as we, too, have found in the automobile industry, orders are not the same thing as sales, and figures for orders do not always give a true basis for estimating sales.

It is a pity that things have not gone according to Republic plans. One admires the enterprise of the manufacturers of the Rainbow, Thunderjet and Seabee. However, it is with the flying characteristics of their little amphibian that I am here concerned.

Short Bros. own a Seabee, supplied by Rollasons, and keep it at Rochester. It was purchased in order to learn as much as possible about its construction and about the behaviour of a small amphibian. This machine they were kind enough to place at my disposal. Their own Sealand, now being built at Belfast, will be more than twice as big and has a lot more than twice the power; however, it will still be quite small as amphibians go.

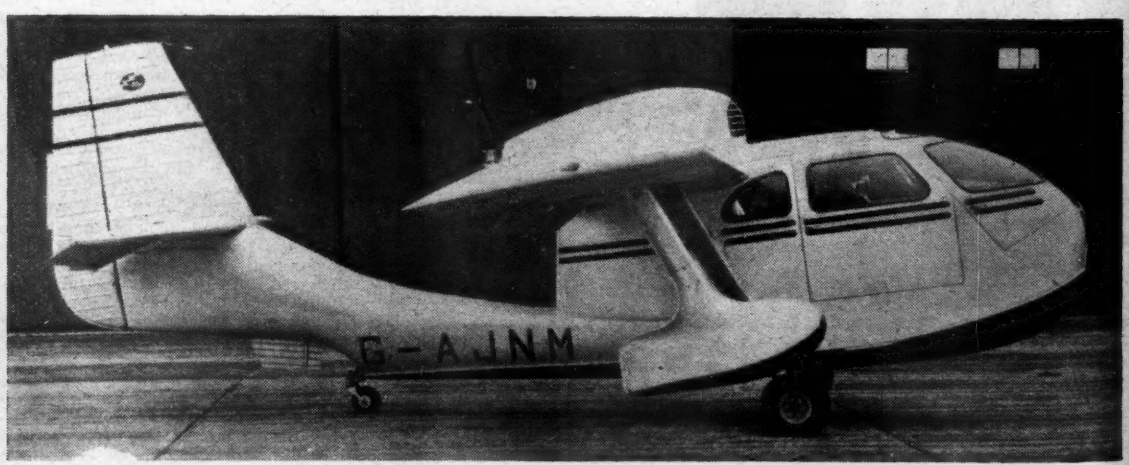
S/L. John Booth, Short's test pilot, showed me round the controls and briefed me on speeds and settings. I was



In level flight the Republic Seabee settles down to a cruising speed of just over 100 m.p.h.

again impressed by the clean, car-like layout of the four-seat cabin. (It may be remembered that many Seabee fittings, instruments, etc., are bought in quantity from automobile suppliers.) An ingenious and apparently effective detail which I had previously overlooked was the friction device for the airscrew pitch lever. This is a loose-fitting rod in a tubular guide, both of which are slightly oval. A small twist of the control knob causes the rod to grip in the guide and so remain at any given setting. I confirmed my dislike of the small, thin-rimmed control wheels.

Before discussing details of the handling characteristics, I should state in general that if Seabees were intended to be turned loose by the thousands on the American or any other public, it is as well that there has been a regression to prevent it. It would not be normal or natural to get "owt for nowt," and the simplification of structure, in particular the adoption of the slab-like, rectangular, even-thickness wing, must have had a detrimental effect on performance. The fact remains that the Seabee is not, in my opinion, suitable for operation at full or near full load except in very wide open spaces. Any idea that the business man with a hundred or so hours of flying should pile luggage and family into a Seabee, hop off the local airstrip and land out in the country on some lake or river for a week-end's fishing, can be ruled out. I flew the machine with one passenger, three-quarter fuel load, and with quite a strong wind blowing. The altitude was sea level for water take-off and 400ft for take-off from land. Under these conditions the figures obtained were not even



In spite of its angular tail but rounded nose, the Seabee looks well on the tarmac at Rochester. The Franklin engine is smooth and flexible and the installation is very neat.

When taking off from the Medway near the Short factory, one strains to gain altitude to clear the high banks. Rate of climb is not a strong point.

as good as those quoted in the book for full-load operation. Some of the flying characteristics are peculiar to all aircraft of the same layout. Occasionally one gets a distinctly Walrus-like reaction from the Seabee.

First take-off was made from Rochester airfield, and it took about two-thirds of the half-mile N.E. run to get airborne. At maximum power and revs the climb was fair, and there was no difficulty about clearing houses on the boundary. One takes off with full flap, the movement being relatively small, and no provision is made for selecting intermediate positions. There is some change of trim on pumping-up the flaps and a little more as the wheels follow. The Seabee is very sensitive to fore-and-aft trim, and stick loads become very heavy if the trimming handle in the roof is not adjusted frequently. The claimed level cruising speed of 103 m.p.h. is attained at the appropriate engine conditions with two up, and the best climbing speed is about 80 m.p.h. At 103 m.p.h. the Seabee seems to reach a sort of critical Mach number, and it is reluctant to fly any faster, even if power is increased.

Approach and Landing

For the landing one works very hard. First the wheels are pumped-down and the trim adjusted, then the flaps are selected, lowered by more pumping and the speed steadied at 80 m.p.h. More trimming must follow, and careful attention must be paid to the throttle to preserve a suitable rate of descent. Too little power or loss of speed results in a brick-like descent which needs a lot of engine to steady-up.

After motoring-in over the boundary and levelling out, speed drops off at once and, before one is quite ready, a sink on to the ground occurs. The very brief hold-off needs plenty of pull-back on the wheel, and there is little "feel" on the elevators below about 70 m.p.h. indicated. Landing speed is about 58 m.p.h. as quoted. A preferable technique may be to trim rather tail-heavy on the approach in order to lighten the hold-off. This is, however, recommended with reserve, as there would already be a tendency to let the speed drop on a correctly trimmed approach without having to push the stick forward to keep up speed.

In flight, I was content to omit stalling and very steep turns from my tests, and for normal manœuvres I found the controls satisfactory. There is a woolliness about the ailerons which is undesirable, and not much fore-and-aft stability, but otherwise there were no complaints nor bouquets.

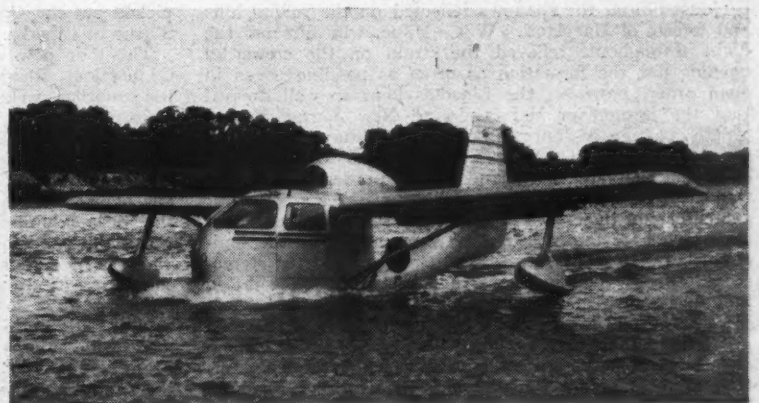
After operating from land I tried a couple of landings on the Medway, which, as a result of the wind blowing against the tide, was a bit choppy. Perhaps it was the novelty of making a liquid landing for the first time for two or three years, or the pleasant feeling of having plenty of room, but I preferred the landing on the hull to that on the wheels. Of course, no one likes a high c.g. on the ground, and I remember feeling quite uncomfortable on more than one occasion on a Walrus as she wagged and wobbled down the runway. Once down, the Seabee shows no tendency in either case to bounce or balloon, and, in fact, behaves well. Take-off from water was quite easy, although again the run was long in spite of quite a stiff breeze. Taking off near the Short works between the high banks of the Medway tended to accentuate the impression that the climb is sluggish. With four up and tanks as full as is permitted, I should think the climb would be less than 400 ft/min.

As a result of cold water spraying on to the outside of the warm cabin, the transparent panels all steamed-up when taxying on the water, and on opening the side flap and two small scoops on top, both my passenger and myself received a pint or two of water in our laps.

Tendency to Weathercock

One point that needs attention is taxying control. Due to the large keel surface presented to the wind, neither the rudder and water rudder together, when afloat, nor the rudder and brakes on land, were sufficient to prevent the Seabee from weathercocking. On landing back on Rochester airfield it was necessary to have a man on the wing-tip float to taxy cross-wind to the hangar. Even so, a brake heated-up in spite of it having been given time to cool off about half-way along the boundary while we made a fruitless search for mushrooms.

During the whole of the two-hour flight the 215 h.p. Franklin engine functioned very well indeed. It started well and seemed flexible, smooth and silent. The pitch-change is quick in action, and the change-over to reverse is simple. Reverse pitch is presumably provided primarily for use as a brake on water. It is something of a luxury



Except for taxying difficulties in a medium or strong wind, the Seabee handles quite pleasantly on the water. A reversible-pitch constant-speed airscrew is fitted, which provides braking power.

Seabee in the Air . . . . .

on an aircraft designed for extreme economy of production.

To sum up my impressions, I would say that the general performance of the Seabee is rather disappointing, and it is certainly not everyman's little amphibian. For full-load operation at least another 20 h.p. is needed. One admits, nevertheless, that it has some intriguing features and is roomy and comfortable. Probably the best employment of the Seabee would be as a light coastal freighter or taxi, to carry small loads from large areas of water to sizeable airfields or vice versa. Full-load operation from high-level lakes and in mountainous country would, I should think, be very undesirable.

A certain high-ranking R.A.F. officer, after flying the Seabee; is reputed to have said, "After that the Walrus is a fighter."

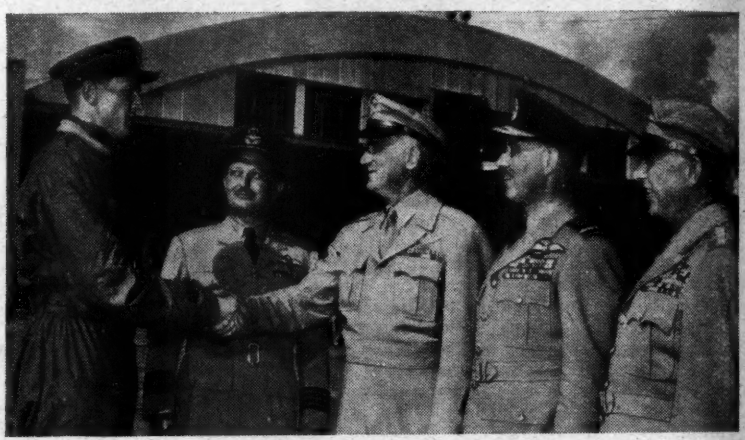
Principal data and the makers' performance figures are repeated on the right. M. A. S.

REPUBLIC SEABEE AMPHIBIAN
Model RC3. Franklin 6A8-215-B8F engine

Performance	
Maximum speed	120 m.p.h.
Cruising speed (75 per cent power)	103 m.p.h.
Landing speed	58 m.p.h.
Initial climb	700ft/min
Cruising range	560 miles
Take-off on land (full load)	800ft
,, on water (,, ,,)	1,000ft
,, time (on water)	25 sec
Landing run (on land)	400ft
,, ,, (on water)	700ft
Weights	
Gross	3,000 lb
Empty	1,950 lb
Useful load	1,050 lb
Baggage allowance with pilot, passenger and 75 gal of fuel	240 lb
Baggage allowance with pilot, 3 passengers and 45 gal of fuel	80 lb
Dimensions	
Span	37ft 8in
Length	28ft
Height	9ft 7in
Track	8ft
Draught (loaded)	18in

617's AMERICAN TOUR

Seeing America on Army Air Forces Day



Squadron Leader C. K. Saxelby (left), a 617 Squadron Flight Commander, is greeted at Andrews Field by General Carl Spaatz in the presence of Group Captain W. J. P. Thomson, leader of the mission, and Air Chief Marshal Sir Guy Garrod.

THINGS continue to go well with No. 617 Squadron of Bomber Command, now touring America. During its six-hours' flight on United States Army Air Forces Day from Andrews Field, near Washington, D.C., the squadron flew in formation over twelve cities of three of the eastern states, and the crews of the Lincolns were privileged to pass directly over the 1,100-foot Empire State Building. Aircraft on the outside of the formation were so close to the skyscraper that it seemed almost feasible to throw a cricket ball on to the gallery where a crowd had gathered.

The take-off of the Lincolns was the first item in the Air Forces Day programme; the arrival of a squadron of Superfortresses after a two-stage flight from Japan, and a "beat-up" by twenty Shooting Stars were other attractions. As the Lincolns flew northward for Baltimore, a correspondent writes, the excellence of the formation could be judged from the shadows reflected on the rolling hills and forests of Maryland. W/C. Milne, who directed the flight throughout, relieved the strain on the crews by opening out the formation as often as possible; even in open order, however, the Lincolns kept so well dressed that the farmers of Maryland and New Jersey saw an orderly pattern of four vics of three as the aircraft sped over at 1,000ft. There were many towns to visit, however, and the Wing Commander had to order close formation most of the way.

Members of the crew who, at Baltimore, were flying over skyscrapers for the first time were impressed by the similarity between what they saw and the exaggerated stereoscopic effect which increases the impression of height in buildings shown in stereoscopic pairs. Five hundred feet was the normal height when flying over towns and when grey Philadelphia was overflown the figure of William Penn on a skyscraper passed as a nodding acquaintance. Fifteen minutes before Philadelphia, the town of Reading, Pa., had been saluted, and less than ten minutes later the Lincolns were over New Jersey and the town of Trenton. There were four airfields to be "beaten up," the first being in Monmouth County, after which the approach was made to New York. The squadron came in from seaward and W/C. Milne keyed up the pilots with a sharp command, "Come in close—New York." Dead on time the bombers passed over the Empire State Building through somewhat turbulent air above the city streets, but the design of the shadows on the deeply serrated city below indicated that their formation was good. As the squadron turned for the return run La Guardia came up under the wings with a packed apron, and two Skymasters slipped in across the bows of the formation. Most of the crews picked out the *Queen Elizabeth*, outward bound past the Statue of Liberty.

The tour now extended north as far as Boston, over Connecticut, Rhode Island and Massachusetts. Near Boston another well-attended airfield—Bedford Field—was crossed at very low level in tight formation, and for the third time New York and the Hudson came up as the squadron made for the rendezvous with the crowds at Newark airfield. Here, as at Bolling Field, Washington, one of the reserve Lincolns had flown to be displayed in the static exhibition. As the British formation flew southwards thousands of people on the beaches of Atlantic City and other resorts saw it close off-shore, and while the Lincolns were approaching Maryland again a formation of Shooting Stars joined company to escort them over the capital. Flying in flights of four the twenty Lockheed jets made wide sweeps over the dense crowds at Bolling Field. From here "617" had just time to gain height to roar over the Capitol and the White House in a salute from the Royal Air Force. Afterwards the Lincolns followed the Shooting Stars into their base at Andrews Field, which houses the Headquarters, Strategic Air Command, the corresponding formation in the U.S.A.A.F. to Bomber Command.

AIRSCREWS FOR GAS TURBINES

Part II—Some Outstanding Features of Specialized Design : Ancillary Equipment : The Self-contained Airscrew

By L. G. FAIRHURST, M.I.Mech.I.

(*Continued from page 134*)

LAST week Mr. Fairhurst reviewed the three basic types of gas turbine and some of the functional problems connected with their general design. In the present article he deals with the related design of such ancillary equipment as spinners, two-speed reduction gears, and de-icing. He concludes with an indication of the types of airscrew that will be required to meet the engine range

THE pilot's airscrew control system for landing or dive-brake airscrews calls for the normal gate in the pilot's throttle box to be extended beyond the slow-running position to give further backward movement for braking.

In the case of the reverse-pitch landing-brake airscrew no deliberate or inadvertent movement of the pilot's control lever can apply reverse pitch until the undercarriage leg is loaded on touch-down. Immediately after touch-down the airscrew reversing circuit is pre-selected, and the removal of an automatic safety lock in the gate allows the pilot to move the lever sideways, which action at once sets in motion the airscrew reversing mechanism. Further movement rearwards opens the engine throttles, so applying an appropriate amount of engine power to the now reversed-pitch airscrew. When the aircraft comes to a standstill, movement of the lever out of the "braking gate" returns the airscrew automatically into positive pitch under constant-speed control.

For the dive-brake airscrew, the aircraft is first brought down to the specified forward speed and engine r.p.m. for dive entry, after which the gate safety lock is removed and a sideways movement of the control lever actuates the airscrew control which moves the blades into windmilling pitch, usually about −3 deg. No re-opening of the throttle from the slow-running position is necessary, as the required braking is obtained from windmilling drag.

In the dive-brake airscrew on a turbine engine the engine r.p.m. before entry into the dive vary according to the particular turbine type, as may be seen from the curves of Figs. 4, 5 and 6 (see last week's issue). Reduction in engine r.p.m. before entering the dive is essential to prevent overspeeding of the airscrew-engine system during the period of time while the airscrew is moving through to windmilling pitch.

Small-diameter Spinners

It was very soon evident that the central-entry turbine unit demands exceptionally small-diameter spinners, with special attention paid to the thickness-chord grading and the blade aerofoil at the spinner periphery. Airscrew hub sockets also have to be designed down to the very minimum height not only to ensure that they are wholly contained within the spinner but also to allow sufficient internal space to give a gradual change in blade section from the root to the aerofoil shape at the spinner periphery. It has also been shown that the cut-outs in the spinner from which the blades emerge must be sealed in an efficient and smooth manner, as this feature plays an important part in the efficiency of airflow into the compressor. Thickness-chord gradings of the blade aerofoil of approximately 25 per cent are desirable at the spinner periphery if the compressor efficiency is not to be impaired too seriously.

Airscrew blades rotating in front of the air intake, even with the minimum thickness-chord gradings possible, have always been frowned upon by the engine designer as causing undue disturbance to the air. Later developments in spinner design are tending towards ducted spinners (see Fig. 7) consisting of an outer rotating shell which lines up with the engine cowling, and an inner rotating shell enveloping the airscrew hub. The contour of the annulus between the inner and outer shells is determined by the conditions of air entry for optimum compressor efficiency. In between these members the airscrew blades are screened by streamlined enclosing cuffs which, at the same time, serve to support the two members. It has been shown by wind tunnel experiments that the ducted spinner gives higher compressor efficiency than the single type, and it is expected that all airscrews of more than three blades will eventually require this type of spinner. Considerable research is also proceeding to prevent ice formation in the duct of the spinner, a problem which must be solved before the airscrew-turbine can be considered established as a safe and efficient form of power unit for aircraft propulsion.

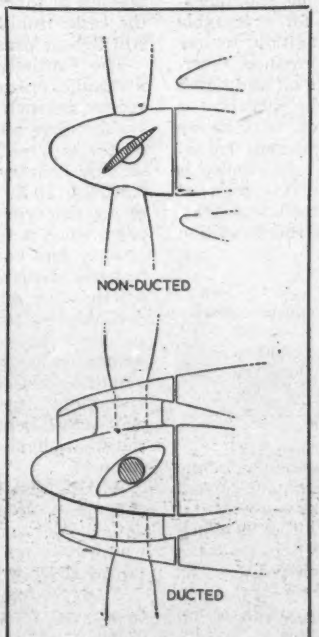


Fig. 7. Diagrammatic representation of arrangement of ducted and non-ducted spinners.

The higher speeds and altitudes envisaged in turbine engines have demanded intensive research into blade aerofoil sections having higher critical Mach numbers, that is, sections capable of operating at higher speeds before serious compressibility losses occur. At the same time, take-off and climb characteristics must not be impaired, especially since I.C.A.O. are becoming more and more stringent on take-off and climb performance with failed engine or engines. For this purpose it would appear that the N.A.C.A. series 16 high-camber section will supplant the Clark Y, as developments carried out to date on the former section show considerable promise. The absence of torsional vibration in the turbine engine has made possible the use of blade sections considerably thinner than hitherto, this feature subscribing considerably to increased efficiencies at high forward speeds.

Further developments in the nature of sweeping back the airscrew blade (see Fig. 8) also raises the critical Mach number. There is little doubt that with the development at present going ahead, airscrew propulsive efficiency of about 75 per cent at 600 m.p.h. at 30,000ft, rising to 85 per cent at the same speed at sea level, will be attained.

On airscrew-driven aircraft with forward speeds of 500 m.p.h. upwards it is becoming very difficult to provide high airscrew efficiencies over the whole range

Airscrews for Gas Turbines . . . . .

of operating conditions. If the airscrew is to give a high efficiency at the top-speed condition, the reduction gear ratio must be so arranged that the airscrew tip speed, when compounded with the forward speed of the aircraft, does not exceed the speed of sound at the appropriate altitude. If this compounded tip speed exceeds the local speed of sound, a serious drop in airscrew efficiency occurs due to compressibility losses.

While the selection of a reduction gear ratio to give top-speed efficiency is practicable, it also gives such low airscrew r.p.m. at take-off and climb as seriously to impair the efficiency under these latter conditions. A piston-engined aircraft at this speed definitely demands a two-speed reduction gear giving high r.p.m. for take-off and climb, and a correspondingly lower r.p.m. for top speed.

Due to the added complication of weight of the two-speed gear, its introduction has naturally been delayed as long as possible and, instead, airscrew development has proceeded on the lines of improving blade aerofoil efficiencies at higher forward speeds. Whilst a certain degree of success has been achieved, the two-speed gear is still left lurking in the background. With the advent of the gas turbine it was found possible to give an overspeed on the airscrew turbine r.p.m. for take-off and climb (a feature not very practicable with a piston engine), the degree of which varies according to the particular type of turbine unit. It would appear that this feature has further staved off the introduction of the two-speed gear.

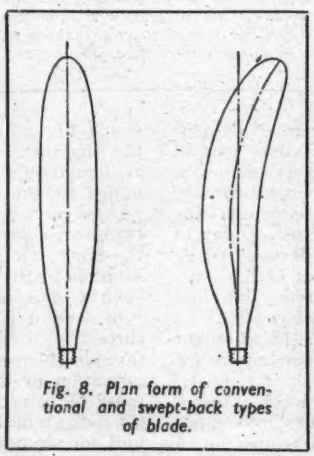


Fig. 8. Plan form of conventional and swept-back types of blade.

A parallel requirement which would also demand a two-speed gear is the limitation, which is being laid down by airline operators, on airscrew rotational tip speed in order to keep down the noise level. Here again, if the reduction gear ratio has to be determined by the permissible airscrew r.p.m. for acceptable noise level under the continuous cruising condition, its low figure would impair the take-off and climb performance. Overspeeding the airscrew turbine r.p.m. for take-off and climb assists in meeting this problem although the salvation is not so pronounced since the cruising r.p.m. of turbines are a much higher percentage of the maximum r.p.m. than applies with a piston engine, and a compromise is invariably essential. The noise level remains high at take-off and climb with either two-speed reduction gearing or overspeeding, but it is fortunate that this condition of flight is of relatively short duration.

Universal Features

Four of the main features which will become universally adopted in airscrews in the near future are:—

(a) Braking, either for use in reverse pitch as a landing brake for the heavier aircraft, or as a diving brake in windmilling pitch for naval aircraft.
(b) Synchronization.
(c) Electric de-icing of airscrew blades.
(d) Hollow steel blades.

The use of the airscrew as a landing brake in negative pitch is quickly becoming universal. Development carried out has shown its effect to be equal to that of conventional wheel brakes, with the added advantage that it is much safer in operation on ice-bound runways. The dive-brake airscrew with blades in the windmilling pitch position has been shown to give very high drag values, e.g., 15,000 lb drag can be provided on an aircraft of 23,000 lb all-up weight. This braking feature of the airscrew is rapidly becoming an essential requirement in the later naval bomber specifications.

Automatic synchronizing of airscrew/engine r.p.m. has successfully passed through its development stages and is being planned for future multi-engined aircraft. In a typical system any engine can be selected as the "master" and the other engines made to follow. The system consists of a small alternator driven by and mounted on each engine, and a "corrector motor" mounted on each airscrew constant-speed unit. The alternator on the engine chosen as master supplies alternating current to the windings on one side of the corrector motors on the "follower" engines, the other windings of the corrector motors being supplied by the individual engine alternator. This results in the corrector motor for each engine rotating appropriately according to the difference in speed between its own engine alternator and that of the master engine, thereby applying the requisite pitch angle correction to any of the follower engines as dictated by the master.

Electric de-icing of the blades is being catered for on all new airscrew designs, temporarily by an airscrew hub-mounted generator feeding the current to the airscrew blades via slip-rings at the rear of the hub. The blade-heating elements at the moment consist either of an electrical conducting rubber envelope completely covering the blade, or a partial element over the leading-edge extending approximately one-third of the chordal width on the pressure and suction faces. Development is proceeding to determine the more practical solution of these two methods.

Steel Blades

The hollow-steel blade offers greater possibilities by permitting the de-icing to be done internally, thus avoiding the necessity for external rubber heating elements with their attendant "adhesion-to-blade" troubles and also the disturbance caused to the aerofoil shape. Over and above the advantage to de-icing, the hollow-steel blade affords greater durability and can also be made lighter than its duralumin counterpart with diameters in excess of 13ft. The absence of torsional vibration in the turbine should remove the early troubles with fatigue failures and make possible still lighter construction.

The entirely self-contained airscrew wherein the hydraulic operating system is integral, and the various accessories such as the constant-speed unit, reversing pump, synchronizer alternator and feathering pump are mounted on the airscrew, has been given very serious consideration in this country, and more so in the United States of America. It is, at the moment, speculative as to whether or not this type will oust the latest editions of the orthodox type, since it further complicates the airscrew, which has already had to cope with the aforementioned additional features demanded by turbine engines. It is doubtful whether the self-contained hydraulic system is altogether desirable, since its limited oil capacity in the event of a sudden leakage and loss of control could have serious consequences to the airscrew and engine. Furthermore, the mounting of all the airscrew accessories on the hub demands an unduly large spinner completely to house these components, this being a distinct disadvantage when designing the small-diameter inner shell of the turbine-engine ducted spinner.

As it has so far been possible to redesign the orthodox type of airscrew to meet every requirement requested to date by the turbine engine, it remains problematical as to whether or not the greater complication of the self-contained airscrew will be shown to be worthwhile.

Airscrew weights for turbine engines show some reduction over their piston-engine counterpart, largely by virtue of the absence of torsional vibratory stresses from the engine system. This saving in weight occurs both in the blade and hub structure; in the former the limit of "thickness" of the aerofoils is now wholly dictated by the steady

(*Continued p. 172.*)

Prelude to GLORY

THIS second excerpt from G/C. Maurice Newnham's book *Prelude to Glory*—from which we are publishing three chapters in serial form—deals with American methods of teaching as compared with our own. The previous excerpt told of the finding of a parachute control technique and the lessening of accidents. The third and last instalment will be the chapter *The Glory and Tragedy of Arnhem.*

CHAPTER 51

YANKEE VISITORS WHO "SPEAK OUR LANGUAGE." BRITISH AND AMERICAN METHODS COMPARED

OVER the portals of the American Parachute School at Fort Benning in 1943 were inscribed the words: "Through these doors pass the toughest paratroops in the World!"

I suppose that taken by and large the Americans appear to a great many Englishmen as an inordinately bumptious race. The Prussian used to force people off the pavement of deliberate purpose. The American jostles man or woman out of the way—if they let him—because it doesn't occur to him to do anything else. Possibly this attitude could be traced back to the bad old days of the late eighteenth century when a party of American Commandos, Rangers, or whatever they chose to call themselves, dumped some packets of tea into Boston Harbour as a protest—which most English people nowadays would approve—against English misgovernment. Since that time a cocky independence has developed as an integral part of the American national character. This particular trait does not, of course, preclude our so-called cousins from possessing many fine virtues.

It has often been said, in a quizzical sort of way, that the British and American peoples would get along better together if they didn't both speak the same language. This is probably meant in the literal sense, although the expression "speak the same language" became a much-used English idiom during the war in a form which meant something different from what the words actually implied.

Thus, if an American parachutist was introduced to an English parachutist the person effecting the introduction might say: "You fellows ought to get on well together—you speak each other's language." He would mean that they had common interests in the subject of parachuting and not that they both spoke English.

Long before America was stung into active war by the Japanese visitation to Pearl Harbour we were extending hospitality and facilities to her Service officers, war correspondents, and others who showed interest in the new Airborne arm. The most important of the early visitors was Mr. Averill Harriman who accompanied Mr. Churchill on that momentous day in April, 1941, when Britain's airborne potential was demonstrated by five obsolete Whitleys and a few single-seat gliders.

He was followed a couple of months later by Brigadier General Geiger of the United States Marine Corps and a party of staff officers. At that time Britain was the only nation engaged in open fighting with the enemy and the Americans were visiting our operational and training units in order to gain the benefit of our active service experience and thus save themselves from the expense of repeating our mistakes.

In the following year came Brigadier General William C. Lee of the American Airborne Command, accompanied by Lieut. Colonel R. Ward. A week or two later came Quenten Reynolds, the famous journalist and broadcaster whose radio talk addressed to Hitler as "Mr. Shickelgruber" almost rivalled in dramatic effect the speeches of our own Prime Minister. Americans were also appearing in increasing numbers among our special "cloak and dagger" pupils—mostly men of Scandinavian and Polish stock who had acquired American nationality.

In August, 1942, we had a party of visitors who were very well able "to speak our language" because they came from the American Parachute School at Fort Benning. The party consisted of Majors Ryder, Yarborough and Thomas and three senior N.C.O.s. They stayed for a week or so, made jumps from the balloons and Whitleys and generally studied our methods. We made them very

All instructors were drawn from the R.A.F. Physical Fitness branch. Ten soldiers formed a section under an R.A.F. N.C.O.; six sections became a syndicate under an R.A.F. officer; and a number of syndicates made up a course. Towards the end of the war courses, such as that seen, often comprised a thousand pupils.

Prelude to Glory . . . . .

welcome, not because of the silly instructions that were circulated telling everyone to be nice to the Americans, but because they were good chaps and we liked them.

One evening as we were driving out to the Roebuck Inn at Mobberley for dinner we passed Rostherne Mere and I casually pointed it out as the place where we made our water jumps. As I did so my mind flashed back to the film *Parachute Battalion* which I had seen in Manchester some months previously. In the picture several American army parachutists dropped into a river and appeared to make a pretty clumsy business of trying to get out of their harnesses. I recounted the story with what I deemed to be a suitable inflection of amused scorn and was surprised to find that it produced a perfect hoot of laughter from our friends. Ryder then explained that he and his party were the parachutists in the picture, having been lent to the film company with the object of introducing propaganda that would be of value in stimulating the recruitment of volunteers. The American parachute harness was a far less efficient arrangement than ours and it was in fact extremely difficult to extricate oneself from it when in the water. It was often said that the chance of survival for American aircrews who baled out over the sea was considerably less than our own because of this inferior design.

Insulated Officialdom

At Ringway we were intensely interested to know what other countries had done and were doing in regard to military parachuting so that we might have a yardstick by which to measure our own results. Unfortunately information of this kind had to percolate through such a sieve of Air Ministry Directorates, Commands and Groups that it very seldom reached the unit to which it would have been of real value. Groups, and occasionally Wings, were normally the lowest formations to which staff officers, as such, were accredited. These insulated officers not infrequently conceived it their function to exercise a restrictive control over the units they were intended to assist. The doling out of driblets of information and instruction which were essential to keep a unit working, without letting it know too much about policy or the purpose of its own efforts, appeared to be regarded as the correct method for preserving the prescience of "higher authority." This practice was particularly galling for a School engaged upon an entirely new subject for which no textbooks or precedents existed.

Consequently the news that an invitation had been received for a reciprocal visit by a party from the P.T.S. to American Airborne Establishments was warmly welcomed. Kilkenny, as chief instructor, was to lead the party and take with him the School's medical and parachute maintenance officers and two senior N.C.O. instructors.

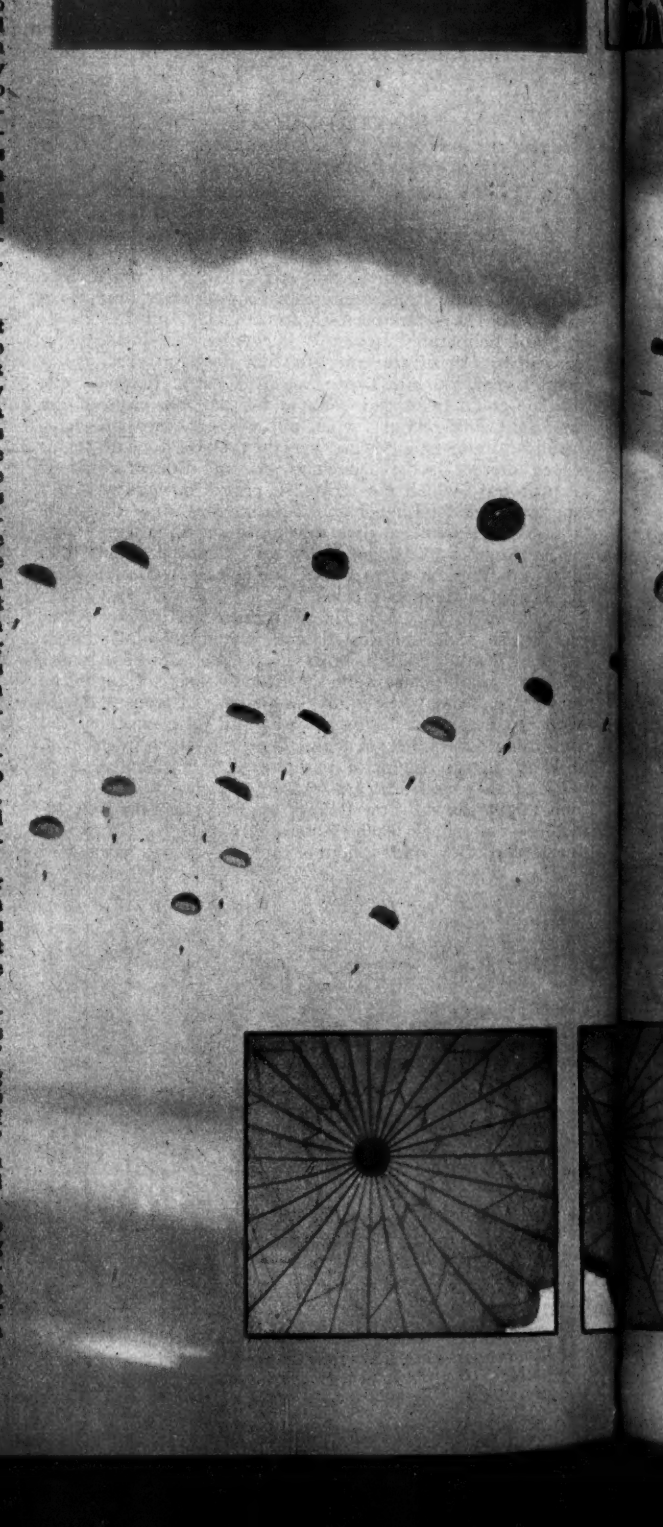
They soon realized that the inscription over the door aptly and accurately summarized the intention upon which the Fort Benning curriculum was based. The methods for producing parachute soldiers were completely different from ours and were only practicable because of the abundant man-power upon which to draw.

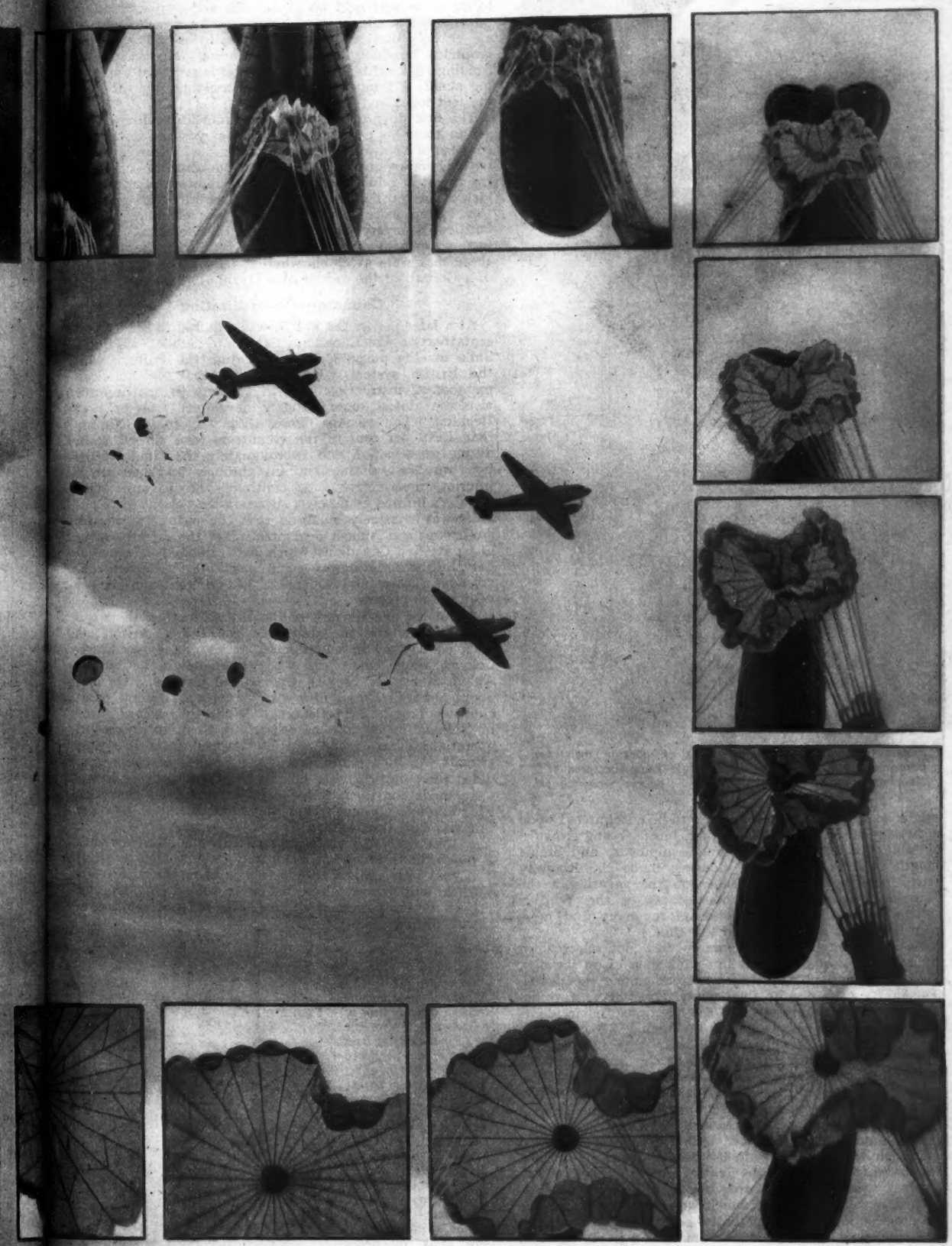
The American conception of a paratroop saw the glorification of personal physical achievement, and this idea was fostered by the use of much bombastic and "tough guy" propaganda. This ran in conjunction with an eliminating period of training which was clearly intended to ensure the survival of only the very fit. The percentage of failures, which were colourfully described as "wash-outs," was extremely high, but the net result was the production of a force of supermen imbued with very high morale and fighting qualities.

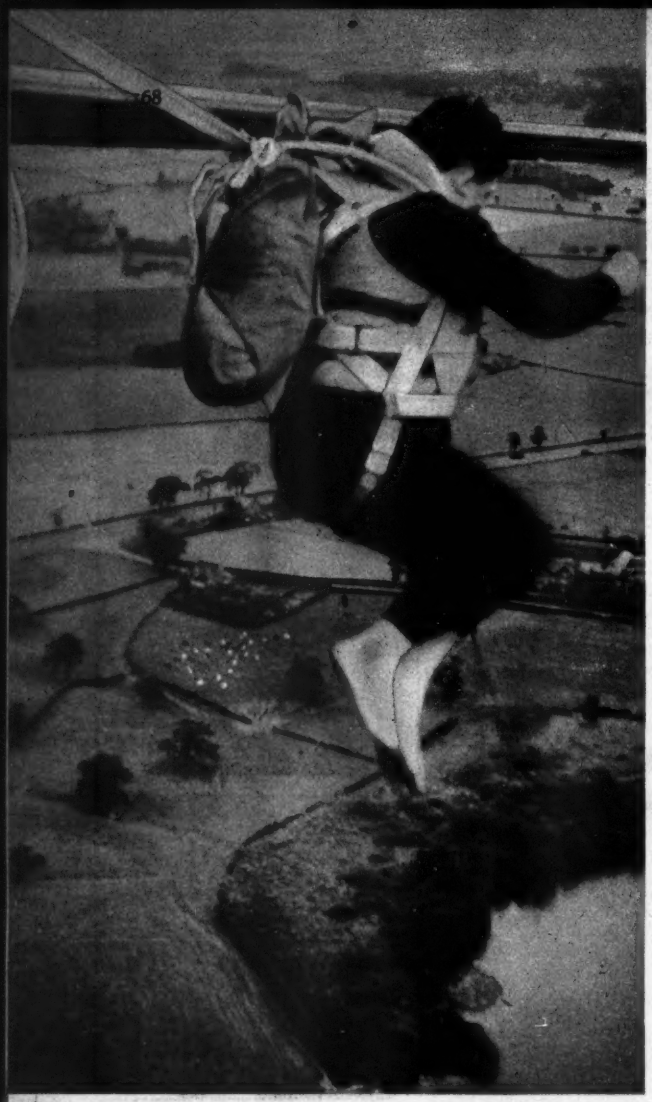
The nature of the training was less concerned with the teaching of parachuting technique than with the building up of the pupil's ambition to achieve the coveted distinction of qualifying as a paratroop. This attitude was partly engendered by the relatively ideal conditions under which parachuting was carried out. Conditions, too, which

WILL IT OPEN ?

Every parachutist experiences this dreadful thought. Hugh Murphy, a P.T.S. instructor, jumped with a cine camera focused above his head. The views fringing this page show the canopy in various stages of development. In the centre is a descent from a flight of Royal Air Force Dakotas.







Professional parachutists would insist on packing their own parachutes, but Leslie Irvin—who should know—accepted G/C. Newnham's assurance that a W.A.A.F. packer was reliable.

might be very different from those to be encountered upon active operations. Perfect weather, ideal landing grounds, suitable aircraft, costly training equipment, and ample length of time allowed for Courses, made the Ringway party reflect with some dismay on the vagaries of the Manchester climate, the grotesqueness of the Whitley "hole" and the constant pressure for more and more men to be trained in less and less time.

At Fort Benning the instructors were not selected for their teaching qualifications but were men of outstanding personality and physique chosen from among the pupils. The injury rate, despite their many advantages, was considerably higher than ours and the blame for the accidents was invariably levelled against the pupils. At Ringway the acceptance of pupils implied their suitability for the military role, and it was regarded as the function of the instructors to give them confidence and teach them how to parachute as a means of transportation into battle. If accidents occurred the instructors, not the pupils, were the persons normally to be blamed. The American injury rate was subsquently reduced following the incorporation into their training of certain British parachuting methods.

In strange contrast to the fighting quality of the finished product were the humiliating and childish punishments, judged by our standards, which were inflicted during the training periods and apparently accepted by the pupils with little resentment. For example, if a pupil was told to jump off a wall and keep his feet together and he failed to do so he was held up to derision and punished. The punishment would require him to perform some feat of an entirely irrelevant character such as touching the ground a hundred times or a degrading activity such as running backwards for a hundred yards repeatedly chanting aloud: "I must keep my feet together, I must keep my feet together."

The first duty of a British parachute instructor was to get to know his pupils as intimately as possible so that he could apply his teaching craft in the most effective ways, by explanation, by example, by encouragement—never by the threat of punishment. If a pupil showed inaptitude or lack of interest he was returned as unsuitable. As a volunteer for specially hazardous duties we felt that he was entitled to every assistance and consideration. There were no men to spare and the best use had to be made of those that were available whether they had the physique of a Goliath or the ardour of a David.

Canadian Co-ordination

At a later period the P.T.S. was required to send representatives to the Canadian Parachute School at Camp Shilo for the purpose of co-ordinating the training with the British system. It was found that the American methods of instruction were in vogue with the punitive elements almost more strongly developed than at Fort Benning. The wastage figures were very high. No less than forty per cent of the volunteers were turned down during pre-selection and approximately the same proportion was lost during training through "washed-outs," injuries, men refusing to continue and so on. With Canada's limited man-power situation the volume of volunteers was relatively small so that the output of trained paratroops was almost negligible. Yet the original party of eighty-five Canadians which had attended a course of parachuting at Ringway in August 1942 achieved conspicuous success and suffered a loss of less than six per cent in the process.

About the effectiveness of the British method there can be no doubt, and the ability of the P.T.S. instructors received a graceful compliment at the hands of Lieut. Colonel Serge Obolensky who commanded one of the American Special Service Operational Groups. He and about a hundred and fifty men had received their parachute training at Fort Benning. While they were located in England it became necessary for them to engage in operations over Europe and be dropped from Liberator aircraft which, like the improvised English bombers, provided the exit through a hole in the floor. Arrangements were made for them to undergo a conversion course at Ringway using English equipment and methods. At the conclusion of the training Obolensky wrote:

> "We were all greatly impressed by the efficiency with which the training was conducted and the high standard of your instructors. They certainly know their job. Our whole unit is now solidly Ringway welded including our Fort Benning men who are sold to your method of parachuting."

A stick of men jumping through the side door of a Dakota. Note the twists in the rigging lines of two partially developed parachutes and the effect of the slipstream on two of the men. The jumper nearest the camera is an experienced instructor and is holding a good position. Under various designations the Dakota was used as a parachute troop transport throughout the war. In the U.S.A.A.F. it is now being superseded by the Fairchild Packet.

Dove Maintenance

Few Faults Discovered During One Year of Operation : Remedies Already Effected or Suggested

LAST week we applauded, in a leading editorial article, the decision of the de Havilland Aircraft Co., Ltd. to issue for publication the "trouble sheets" of the Dove aircraft and its Gipsy Queen 70 engines. There is now available the accumulated experience of one year's operation in many parts of the world and in a wide range of climates.

Below we publish the faults list for the Dóve so far as maintenance experience is concerned. In each case the remedy, suggested or already effected, is placed against the fault. It will be seen that the troubles are, in the main, fairly minor ones. We have not the space to publish the corresponding faults list for the Gipsy Queen 70 engine, but again the frank statement indicates no really serious trouble.

DE HAVILLAND DOVE

AIRFRAME

Faults	Remedies
WINGS	
1. Perspex cover of navigation light loses colour in strong light.	Alternative type of navigation light is being considered.
2. Underside of flap-shroud requires hole for bar to tap out flap mounting bolts.	A hole has been introduced in production and a modification issued.
UNDERCARRIAGE	
1. Operation of radius rod locking lever affected by grit, etc.	*Mod* 193 modifies kidney slot to give greater clearance, now prevents jamming.
2. Wear in undercarriage leg torque links.	*Mod.* 229 introduces shims which have eliminated trouble.
3. Undercarriage indicator green light failure due to indicator change-over switch not being at full travel.	Modified indicators are being issued.
4. Grease nipples on pin attaching main undercarriage jack ram-shaft to leg are too close to wing rib when retracted.	A modification has been issued which provides for the rib to be dressed back.
5. Nose wheel fairings require water drain.	Two drain-holes have been provided and instructions for local mod. issued.
POWER PLANT INSTALLATION AND SERVICES	
1. Failure of bush in Metalastic mount in isolated cases.	Material of centre bush in Metalastic mount changed from dural to steel.
2. Damage to oil tank sustained during taxying.	*Mods. PP* 15 and 106 or *PP* 16 and 107 provide an additional support bracket on the wing and a stiffer oil tank.
3. Time to feather considered too long.	*Mod. PP* 13 introduced increased capacity feathering pump.
4. Oil seepage from tank to engine when aircraft out of service.	A valve is being provided. Interim action calls for turning the engine every 24 hours.
5. In extreme cold the oil temperature failed to reach 30° C.	*Mod. PP* 27 introduced a 75 per cent blank for the oil cooler.
6. Oil tank water drain unsatisfactory.	*Mod. PP* 45 provides wire locking.
ELECTRICAL APPARATUS	
1. Tilting of batteries reported.	*Mod.* 97 provides attachment plates stabilizing batteries.
2. If the undercarriage locking lever micro-switch sticks the pilot will get a green light in all positions except u/c up, whether undercarriage is locked down or not.	This is being investigated and a Modification Memo will be issued.
3. Downward identification light Breeze plug affected by water.	Plug now faces downward to avoid water entering.
4. J-type relay inaccessible under old-type radio.	It is fully accessible with the new radio installation.
COCKPIT AND INSTRUMENTS	
1. Canopies crazed over removable sun shield, due to effect of nitro-cellulose silver finish of shield.	*Mod.* 174 changes paint scheme of sunshield synthetic lacquer, white top, grey underside.
2. Deviation in compass reading.	*Mod.* 40 introduces non-magnetic trim cables: instructions issued to operators to avoid stowing large steel objects in front baggage compartment.
3. Inner radial flange and retaining screw of brake parking knob break.	*Mod.* 37 changes material from plastic to metal.
4. Inadequate labelling to indicate position of pneumatic shut-off cock.	*Mod.* 157 provides position indicator label for master air valve.
5. Glare through side of cockpit.	*Mod.* 143 provides cockpit sunblinds.
6. Direct vision window parting spring too stiff, requiring two-handed operation.	Modification in progress.
7. Brake lever too far forward and too stiff.	*Mod.* 202 re-rigs brake lever on production aircraft.
8. Cockpit cooling inadequate in tropics.	*Mod.* 44 introduces a redesigned heating valve.
CABIN	
1. Ventilating louvres require silencing, and ventilation inadequate.	Modification action is being taken to reposition the louvres for greater efficiency, and to silence them.
2. Hand grip found desirable to assist entry to aircraft.	*Mod.* 221 provides a hand grip.
3. Rear cabin door requires a stop.	*Mod.* 146 provides a stop.

Round the World in 73 Hours

Capt. Odom's Solo Flight Record

A NEW solo round-the-world flight record was established last week when Capt. William P. Odom, former British ferry pilot, landed at Chicago Municipal Airport last Sunday after encircling the world in 73 hr 5 min. He beat the previous round-the-world solo flight, set up by the late Wiley Post in 1933, by 113 hr 45 min. Capt. Odom also beat the round-the-world flight record of 78 hr 55½ min which he established with Mr Milton Reynolds, the millionaire pen manufacturer, last April.

Flying a modified Douglas A26, the "Reynolds Bombshell," Capt. Odom left Chicago on Thursday, August 7th, at 6.53 p.m. B.S.T. and made eight stops before landing there again on Sunday, August 10th, at 7.58 p.m B.S.T He spent only 9 hr 50 min on the ground for refuelling, and his average speed, including ground time, was 269 m.p.h. His average flight speed was 310.59 m p.h.

The worst part of the flight, Capt. Odom stated, was over the Burma hump. "I flew into a monsoon there, and the aircraft bumped so badly that my chair rolled off its track and cut a cable, knocking out the automatic pilot."

The log of Capt Odom's record-breaking flight is given below. All times are given in B.S.T.

Thursday: 6.53 p.m., left Chicago.

Friday: 1.50 a.m., left Gander, Newfoundland; 7.1 a.m., passed over Shannon Airport, Eire; 10.32 a.m., left Paris; 4.34 p.m., left Cairo.

Saturday: 2.30 a.m., left Karachi; 8.43 a.m., left Calcutta (half-way mark); 3.42 p.m., by-passed Shanghai; 9.17 p.m., left Tokyo.

Sunday: 9.47 a.m, left Anchorage; 6.19 p.m., left Fargo; 7.58 p.m., landed Chicago.

(*A picture of the start appears on p.* 158.)

REGINALD NOEL AVELINE

THE many friends he had throughout the industry and the Bristol Aeroplane Company will keenly feel the loss of Mr. R. N. Aveline who, after a sudden illness lasting but two or three days, died suddenly on August 7th. He was 45 years old.

Design and Psychology

Relationship of Cockpit Layout and Instrument Representation to Human Error and Safety

QUITE a lot is heard about designing cockpits to suit pilots, but the practical result has been rather disappointing, and it has been suggested that if the designers of large aircraft together with their radar and instrument-producing fellows are not held in check, it will be necessary to breed pilots to suit the cockpits. Generally speaking, American aircraft have been a good deal better than our own in this respect. Wartime pilots will bear me out in this remark, possibly excepting their own pet machine (which would be forgivable and for which allowance can be made on sentimental grounds).

In one important detail I, too, might mention a general exception, namely, our standard blind-flying panel which does seem to be simpler and more "standard" than its foreign counterparts. Anyone who has had to do a lot of night flying knows the value of this familiar standard layout and will know also how demoralizing can be an aircraft with a different arrangement of dials and instruments. However, that is by the way and may all be wrapped up with familiarity and habit.

Some aspects of cockpit design and layout are definitely bad and even dangerous, although they may be quite familiar to the pilot. To stop pilots moving the wrong control and folding their wheels up on the ground instead of perhaps raising the flaps, it was early found necessary to provide a safety catch on the undercarriage lever. In theory at least, it ought to be possible to separate the two levers conveniently and to make the "feel" of their knobs sufficiently different for confusion to be impossible.

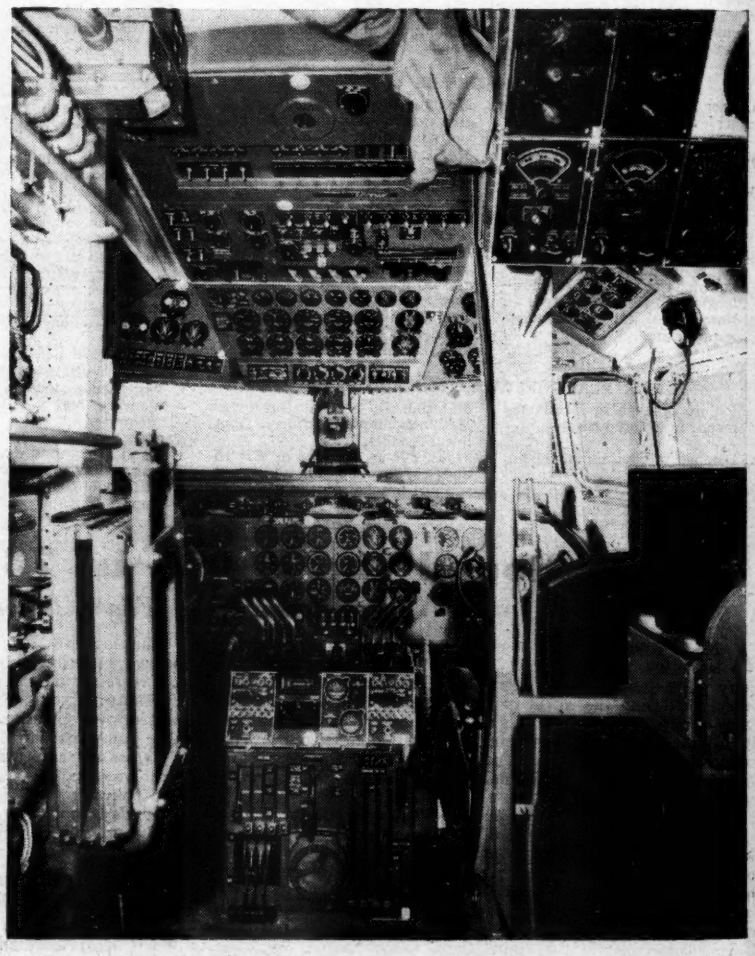
The Wrong Knob

Lives were also lost during the war due to the feathering of the wrong airscrew following engine failure on a "four." A Sterling or Lanc, for instance, lost its port outer on a circuit; the pilot's or engineer's thumb went out to press one of the grouped feathering buttons and in the panic of the moment (perhaps because, as the psychologists tell us, a man reaches short when feeling for something without looking), the port inner was feathered. Investigating officers sometimes suggested that the crew did not know which of the two motors had died on them, and certainly it is not always easy to tell, but in my opinion it was as often as not a feathering fault concerned only with knob-selection.

Misreading of instruments has been another important cause of accidents. It is probable that improvements could be made to the dials of almost all existing aircraft instruments. The design of dials cannot safely be left to the man with an eye for proportion or colour, or even to the production drawing office. The best way to get the representation right is to try out the reactions of a large number of aircrews to various arrangements of figures, needle movements etc., and thus to select the most suitable. I am not personally in favour of the type of dial used on some A.S.I.s, where the scale is marked quite differently between 0 and 100 m.p.h. and 100 upwards.

The current two-needle dial, with large and small hands like those of a clock, is another confusing design, particularly when applied to the altimeter. Cases of baling out after mistaking 12,000ft on the dial for 2,000ft during spin recovery, or of reading 100ft as 1,000ft and clipping the tops off trees or hills, have occurred in almost every country. Such mistakes are, of course, more likely to occur at night, but they might be avoided altogether.

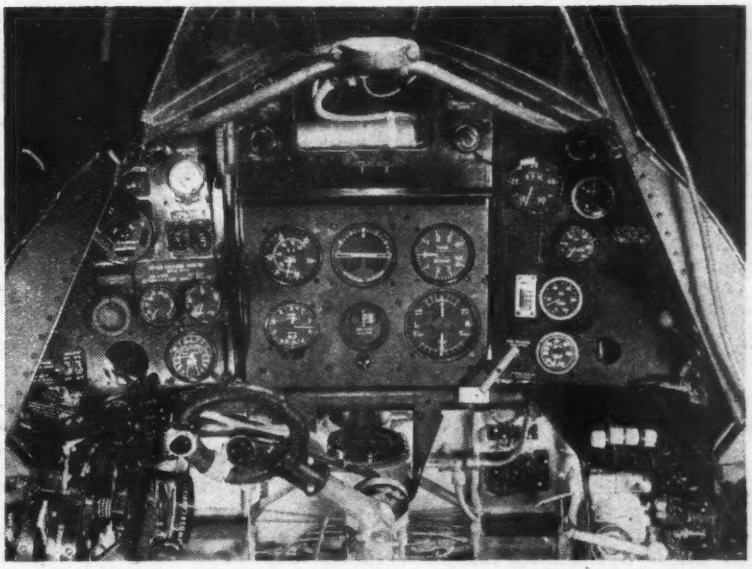
Some interesting observations and examples of such display and control shortcomings have been recorded by the psychological branch of the American Aero Medical Laboratory, engineering division, at Wright Field, after questioning a large number of pilots. In a paper read before the Society of Mechanical Engineers in Boston,



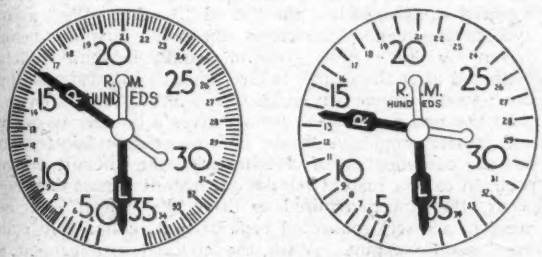
A good example of the crew's compartment, pilots' controls and instruments of a modern four-engined transport. By present standards, though complex, this D.C.6 cockpit is well planned.

Mass., a number of these were quoted, and Paul M. Fitts, the author, says at one point: "I do not believe that it will ever be possible to eliminate all human errors in the use of equipment, especially of equipment as complicated as an airplane. Nor do I believe that there is a single short cut to the reduction of pilot error. Progress must come gradually through better selection of pilots, through better training and maintenance of training, and through better design of equipment. The evidence, however, indicates that substantial improvement can be achieved by designing equipment in relation to human capacities and characteristics."

In all, ten different studies, made as part of a scientific research into human problems in equipment design, were discussed. One and two concerned the design of dials for a 24-hour clock and the improvement of air navigation plotters with a view to reducing errors. The third and fourth, made by Dr. R. B. Loucks of the A.A.F. School of Medicine, concerned the markings on rev counters and artificial-horizon indicators. He found in the first case



A central fe ture of a typical single-engined British fighter cockpit is the standard blind-flying panel with artificial horizon in the middle.



Rev counter dials graduated in 20 and 100 r.p.m. divisions respectively were used for an investigation into optimum scale markings at the American Air Force's School of Medicine.

that the dial with fewer intermediary markings was read with significantly fewer errors during brief periods of exposure. The graduations, which are illustrated, indicated 20 r.p.m. and 100 r.p.m. respectively. A point of interest concerning the artificial horizon was that inexperienced subjects reacted best to an instrument which had been modified to move in exactly the opposite sense to the conventional one, i.e., with the moving element rotating clockwise when the aircraft rolled to the right.

On reflection this does not seem so surprising, and it is probable that many pilots will remember their own difficulty, when first learning to use the artificial horizon, of putting the wing back on to the horizon rather than putting the horizon, the moving element, back on to the wing, I remember thinking, although I dared not say so at the time, that I was being made to learn to react to an instrument designed to suit the maker rather than the pilot. Once the mind has learned to translate the indications into automatic corrective foot-and-hand movements there is admittedly little trouble with the present instrument.

Investigation number five concerned the actual movement and type of controls, and so far it has been established that when trying to centre a spot of light on a screen, the horizontal movement of the spot is controlled most accurately by a left-hand control mounted on a vertical shaft, and the vertical movement of the spot by the right-hand control mounted on a horizontal shaft. In addition, subjects were more accurate when the side of the knob nearest the display was moved in the direction in which it was desired for the display to be moved.

A sixth investigation, into the relative accuracy of feet and hands for control movements, showed that the use of the rudders by the feet was less accurate than the use of the stick or wheel by the hands. No difference was found between stick and wheel for aileron and elevator movements, but it was discovered that most pilots could make fore-and-aft or elevator control movements more accurately than lateral or aileron control movements.

Pressure Application

Results of study seven on the accuracy and consistency with which pilots can apply specific pressures to flying controls showed, for what it is worth, that accuracy is considerably greater at the higher pressures. For example, in attempting to apply 1-lb pressure a pilot is likely to be in error by about 20 per cent, but for a 20-lb pressure the error observed was only 7 per cent.

The accuracy with which a pilot can reach to different positions in a cockpit without watching the movement of his hands was the subject of the eighth examination. Briefly summarized, the results showed that controls directly in front are reached for most accurately. In the other areas, controls farther to the rear than 90 degrees, and controls above the level of the shoulders, are reached for least accurately. Consistent error patterns were discovered, and it was noted that when pilots reach upwards or downwards they tend not to reach far enough.

In order to be able to recommend a set of differently shaped control knobs that can be easily recognized by touch alone, study number nine was undertaken. A large num-

From 22 different knobs, 8 basic shapes (above) were selected among which there was no confusion when identified by touch alone.

Design and Psychology . . . . .

ber of pilots tried to identify each of 22 knobs mounted on a vertical panel. From the results, 8 basic shapes were selected among which there was no confusion when identified by touch alone. These are illustrated. The last study involved comparison of the accuracy of tracking and framing a moving target with different types of handgrip controls.

From the evidence of the series of investigations mentioned above, and from the many other examples which will occur to readers, there is little doubt that great improvements could be made in cockpit layout and design if it were approached from the psychological or human limitation point of view. It is gratifying that there has been a considerable improvement in this connection in recent British aircraft. The application of colour to controls and dials, a subject which was not mentioned above, would form the basis of another interesting and useful research.

Although the grouping of some types of controls is undesirable for fear of confusion, the grouping of such instruments as temperature and pressure gauges is to be advocated. The introduction of compound instruments carrying two or more dials may offer some advantages but generally leads to a more confusing representation. From the point of view of production, servicing, replacement and observation, simple like instruments arranged in banks, and with their needles parallel at their correct normal reading, seem to offer the most advantages for the engineer's panel. The important requirement in this case is to notice as soon as possible that a reading is not what it should be, after that the instrument can be identified by its label, and finally the exact reading may be taken.

M. A. S.

AIRSCREWS FOR GAS TURBINES

(Continued from page 164)

stresses, and the avoidance of torsional or flexural aerodynamic flutter in the blades.

It would now appear possible to design turbine airscrews to 0.16 to 0.2 lb per b.h.p., taking the take-off power as the basis. Airscrews for gas-turbine engines range from 500 b.h.p. to 7,000 b.h.p. It is difficult to be definite on the range of power covered by any particular type, as the diameter permitted by the aircraft design largely dictates the number of blades required. However, to give some idea of the types required to meet the engine range, the following table can be taken as a guide:

In every case the airscrews will be constant-speed, feathering, and convertible where desired to either dive or landing-brake functions.

3-blade 500-1,000 b.h.p.	6-blade contra-rotating, 3,000-5,000 b.h.p.
4-blade 1,000-2,500 b.h.p.	8-blade contra-rotating, 5,000-7,000 b.h.p.
5-blade 2,000-3,000 b.h.p.	

The application of the contra-rotating airscrew on single-engined aircraft will be almost wholly applied to naval deck-landing aircraft employing power units of from 3,000 to 4,500 b.h.p. Powers beyond 4,500 b.h.p., if achieved by coupling together two engine units, will drive contra-rotating airscrews. Whether the coupling between the engines and airscrews will be such that both engines drive the complete contra-rotating airscrew, or, alternatively, each engine drives its own half of the airscrew as an independent unit (known as co-axial) depends largely upon the peculiarities of the type of engine and aircraft under consideration.

It is a debatable point as to which system offers the greater attraction. With the first arrangement, in the event of failure of one of the coupled engines, flight will be sustained by the other engine still driving the complete airscrew, but now at a slightly finer pitch than that previously required to accept the total power of both engines. In order to prevent the "good" engine having to drive the "dead" engine, instantaneous release clutches will be required so as to isolate the "dead" engine. With a co-axial arrangement of airscrews, the half which was being driven by the "dead" engine would be immediately feathered after the engine failure, flight being sustained by the "good" engine driving its own half of the airscrew.

Of the two systems the former gives a quicker recovery and greater propulsive thrust after one engine failure, but has the complication of clutches with the difficult design problem to give instant release. If instant release does not occur, the power required to drive the "dead" engine may, in a direct-connected type of unit, completely stall the "good" engine. With the co-axial arrangement a lesser propulsive thrust is obtained by the "good" engine driving only one-half of the airscrew, and a greater period of time occurs before this thrust is available, since the feathering operation has to be completed in the intervening period. The co-axial arrangement does, however, avoid the problem of engine clutches.

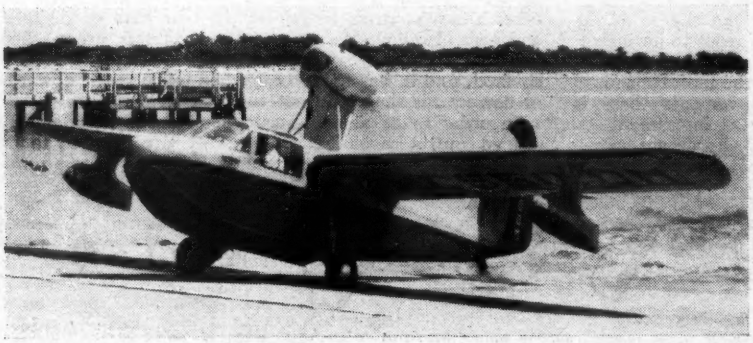
SPORTSMAN'S AMPHIBIAN

A NEW three-seater amphibian designated the GA-2 has been developed by the Goodyear Aircraft Corporation in America, and is now undergoing its flight trials. The amphibian's cockpit has side-by-side seating for pilot and co-pilot, and one passenger seat behind them. The wheel control, mounted from the instrument panel, leaves plenty of leg room for the pilot and a baggage compartment, measuring 11 cubic feet, is provided. The wide, conventional landing gear and the tailwheel are fully retractable and are operated electrically, with a hand crank for emergency operation.

The wings (span 36ft) are full cantilever of metal construction with fabric covering. They have wing-tip slots.

Power is supplied by a 145 h.p. Franklin horizontally-opposed engine mounted as a pusher on a pedestal on top of the wing. Cruising speed of the GA-2 is given as 110 m.p.h. and the top speed at 125 m.p.h. Landing speed is approximately 50 m.p.h. The take-off run from water is 1,300ft and the range approximately 370 miles.

The problem of cooling pusher-type engines has always presented difficulties. On the GA-2 this has been facilitated by an engine-driven fan mounted on the propeller hub. The aircraft is equipped with basic instruments, two-way radio and a push-button electric starter.



The Goodyear Aircraft Corporation's GA-2. The aluminium-alloy wing-tip floats are mounted high enough to prevent damage on small obstructions when operating from land bases.

Municipal Airport Opened :

Merchantman's First Flight :

News About Two Tudors

CIVIL AVIATION NEWS

THE DUTCH WAY : The public enclosure and restaurant at Schiphol, near Amsterdam. Large crowds gather to watch the ever-increasing air traffic into the international airport.

SOUTHEND AIRPORT

OFFICIALLY the airport at Southend was opened on Saturday, August 9th, but flying activities have been going on there for some time. The airport is owned and controlled by the municipality, and a flying school has been formed to provide instruction and private flying without membership or entrance fees. The fee for dual instruction is £3 5s on any one of the three Austers or the single Tiger, and £2 17s 6d for solo flying. British and Continental Airways, Ltd., with one Anson, two Proctors and a Vega Gull, and East Anglian Flying Services, Ltd., with an Aerovan, Courier, Puss Moth and an Auster, are already established, and flying frequent charters to the Continent.

The enclosure will be open to the public free of charge, there is already a restaurant, limited residential accommodation and a swimming pool, and tennis courts are to be constructed. Many other amenities will be provided to make this airport a centre of aviation in the area, and a general sports centre. Passenger handling facilities are poor at present, but plans have been drawn up for the provision of buildings for administration and to accommodate Customs, immigration, and offices for other charter companies, and perhaps scheduled airlines. The airfield has a 1,500-yard take-off run in each direction and full night-flying equipment is going in. Mr. Bernard F. Collins, the airport manager, is hoping for R/T D/F in the very near future. The Southend-Romford-London railway line borders the airfield, and the L.N.E.R. have already purchased land on which it is intended to build a station for the airport.

Mr. Lindgren opened the airport at the invitation of Alderman W. Miles, C.B.E., who was deputizing for the Mayor. Air races and a display followed, and we understand that the municipality intend to make the International Rally and races an annual event. The Southend Cup was won by Mr. R. R. Paine in a Miles Hawk trainer; the Shipside Cup was won by the chief flying instructor of the airport, Mr. A. E. A. Parsons, flying an Auster, and the fastest time of the day was made by Mr. Tommy Rose in his Hawk Speed Six. The arrival competition for aircraft from abroad was won by Mr. Guy Fecheyr of Ghent.

Further details of the Air Display and the racing will appear in next week's issue of *Flight*.

TRANSPORT PREMISES

THE Institute of Transport has purchased the lease of No. 80, Portland Place to provide a centre for members. The amenities will include conference rooms, a library and a common room. Last year Sir Frederick Handley Page made an appeal for contributions to an endowment fund in order to secure new premises, and a target of £100,000 was set. Donations and promises have been received amounting to over £60,000, and the Institute are anxious to reach the target.

NEW UNDER-SECRETARY IN M.C.A.

THE Ministry of Civil Aviation have announced the appointment of Mr. R. Abraham to succeed Mr. G. S. Dunnett as Under-Secretary (Air). In this capacity Mr. Abraham will have charge of the department dealing with all matters (other than questions on airfields and technical services) arising between the Ministry and the three U.K. Airways Corporations; U.K. and overseas charter flying operators; Commonwealth and foreign airline operators; and private flying and gliding interests.

Mr. Abraham joined the Ministry of Civil Aviation in February, 1946, serving first of all in the Aerodromes Division, and later he was in charge of the Personnel and Miscellaneous Flying and the Air Services (General) Divisions, which form part of the Air Services Department. Mr. Dunnett has been promoted to Deputy Secretary in the Ministry of Agriculture and Fisheries.

BIG BROTHER : Outside the Woodley flight shed prior to its maiden flight the Miles Merchantman prototype looks what it is, a four-engined, all-metal version of the Aerovan.

GARDERMOEN OR FORNEBU

BRITISH EUROPEAN AIRWAYS are compelled to use Gardermoen Airport for services to Oslo, as Fornebu, the alternative, is not large enough to accept Vikings. Gardermoen is forty miles from Oslo, and the best surface transport connection with the city is by road across the mountains separating the plain on which the airport is situated and the fjord.

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During the winter months the roads are ice- and snow-covered, and travelling time is often greater than under normal conditions. Fornebu, on the other hand, is only seven miles from the city and is connected by a road which runs along the edge of the fjord and is not affected so severely by snow and ice in the winter.

Gardermoen—which has two runways, both of which are more than 2,000 yds long—lies in a plain 66oft above sea-level and is subjected to heavy snowfall and an average low temperature in consequence. It is also the centre of military flying in Norway, and the presence of Service training and operational aircraft is a constant danger to civil airlines. Fornebu, which has three runways measuring only 420 yards, 1,310 yards and 765 yards, the latter being seldom used, lies at the edge of Oslo fjord, and the land to the north rises to about 2,oooft. The airfield is at sea-level, and, in consequence, has a higher temperature and less snow than Gardermoen, and, owing to the mountainous country on one side, has a fairly constant prevailing wind, take-off normally being in a southerly direction over the fjord. The safety height for a radius of twenty miles around Gardermoen is 4,oooft, but around Fornebu it is only 2,3ooft.

In 1945 an aeronautical commission examined the case of Fornebu as the international airport, but decided against its use, the main reason being the lack of forced landing sites should it be necessary after take-off. It would appear, however, that the danger might equally apply to Gardermoen. The difficulties of fitting landing aids at both airfields are similar owing to the detrimental effect on beams by the presence of high ground, but an adaptation of the S.B.A. system can be applied in both cases.

In the circumstances it is surprising that B.E.A. are operating Vikings to Gardermoen, as there seems to be a good case for reverting to Dakotas and using Fornebu. More regular schedules could be flown in the winter, and the safety factor would almost certainly be higher. Plans have been prepared for the development of the airport at Fornebu, but they are still under consideration. Should they be developed, and other runways built, the airport should become a first-class terminal.

B.E.A. AIRCREW

BRITISH EUROPEAN AIRWAYS have no vacancies for pilots at present, and any vacancies in the future will be announced in the Press In the meantime, pilots are asked not to apply. The minimum qualifications which will be required are "B" licence and 2nd class Navigator's licence, with experience on multi-engined aircraft an advantage. Pilots more than thirty years old will not be accepted. The Corporation do not employ straight navigators but there are vacancies for radio operators with the P.M.G. air licence and previous flying experience.

Vacancies occur from time to time for stewards and stewardesses, and there is a tendency to employ more of the former owing to the shorter operational life of stewardesses for rather obvious reasons. The preference of passengers for male or female is divided.

AER LINGUS SERVICES

ON August 1st Aer Lingus started scheduled services from Dublin to Glasgow and Belfast, and also through Shannon to London. The total route mileage has thus been increased to 53,890 each week, with a passenger-carrying capacity of 5,570. The direct route from Dublin to London, on which Vikings are flying, remains the busiest in the system, and services have been increased to eight each way daily. Next year the company expect to open up services from Dublin to Stockholm, through Glasgow to Oslo, from Shannon to Paris, from Dublin to Rome, Geneva, Madrid, Lisbon, Bristol and Newcastle-on-Tyne. A seasonal service is also contemplated from Dublin to the Isle of Man, but the opening up of those routes will depend upon the delivery of new aircraft. The Aer Linte transatlantic service has been postponed until the spring of 1948, and it is expected that in the meantime the Constellations will be made available for the Dublin-London service, and will be put into operation by the end of October.

Capt. J. C. Kelly Rogers will be leaving shortly for Burbank to take delivery of the first aircraft. Senior captains have been training at the Lockheed airfield, and by the time the first Constellation is delivered, probably at the end of this month, Aer Lingus will have several fully trained crews. It has been announced that Capt. O. P. Jones has relinquished his post as chief pilot of Aerlinte Eireann, and the name of his successor will be announced shortly.

MERCHANTMAN FLIES

KEN WALLER, chief test pilot of Miles Aircraft, Ltd., took the company's latest aircraft, the Merchantman, off on its maiden flight on Thursday evening, August 7th. The Merchantman is a four-engined, all-metal big brother of the Aerovan and is capable of carrying a payload of 5,000 lb or can be used as a 20-seater feeder-line type. Waller made a large circuit of Woodley airfield, being airborne for about 10 minutes and expressed himself as being well satisfied with the aircraft's qualities.

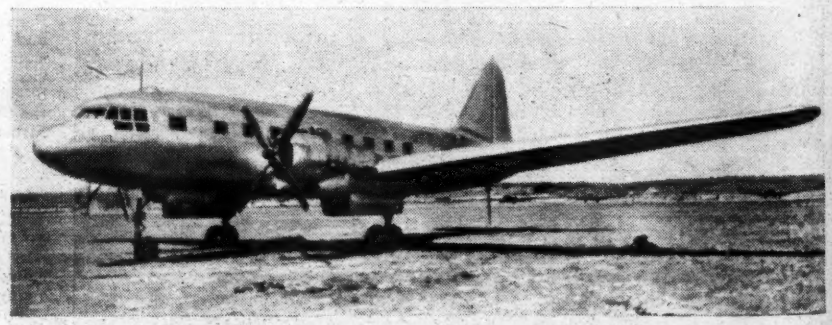
I.A.T.A. MEETINGS

THE I.A.T.A. Technical Conference will be held at Nice from September 1st. Discussions will be divided under the four main headings of Operations, Engineering and Maintenance, Aids and Facilities, and Communications and Radio Aids, and the recommendations of the conference will be placed on the agenda for the third annual general meeting at Rio de Janeiro beginning on October 14th. I.A.T.A. observers will be taking an active part in the technical meetings of I.C.A.O., when the safety problems are discussed at the general meeting. Meetings arranged for the next three months are as follows:—

Financial — Insurance Sub-Committee	Paris	August 21st
Financial — Accountancy and Statistical Sub-Committee	Paris	August 25th
Financial — Clearing House Sub-Committee	Paris	August 28th
Technical Conference	Nice	September 1st
Financial Committee	Brussels	September 3rd
Technical Committee	Nice	September 16th
Executive Committee	Rio de Janeiro	October 6th
Traffic Committee	Rio de Janeiro	October 7th
Third Annual General Meeting	Petropolis (Brazil)	October 14th
Executive Committee	Petropolis	October 20th

MASCOT ALTERNATIVE

EARLY this year the P.I.C.A.O. Regional Committee selected Dubbo as the alternative bad weather landing ground to Mascot, the international airport for Sydney. At the time it was thought to be a strange decision in view of the limitations of Dubbo and the extensive development which would be necessary for efficient operation. At present the airfield has one landing strip 2,000 yards long, and no passenger-handling or administration facilities. The R.A.A.F. station at Narromine, on the other hand, about twenty miles away, has two runways 2,600 yards long, water, electricity



RUSSIAN TRANSPORT: The new twin-engined IL-12 Russian passenger aircraft designed by Sergei Ilyushin to operate on internal civil services. Accommodation is provided for 27 passengers and a crew of four.

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and sewerage already installed, and a control tower, hangars and administrative buildings erected. The airfield even has night lighting and obstruction lights.

It is understood that Dubbo is also subject to fog, while Narromine has a reputation for being free, except on very rare occasions. It is estimated that the cost of bringing Dubbo to the same standard as Narromine would be £A150,000. The Australian Civil Aviation Department made further investigations after representations had been made, and the final decision has been deferred pending consideration of the report which will be submitted.

BREVITIES

B.E.A. have opened a town office at the railway station at Douglas, Isle of Man. It is open for enquiries and bookings.

* * *

Orly Airport, near Paris, is to have a parallel runway system, and the French authorities hope that by 1950 the airport will be capable of handling about eighty aircraft per hour in instrument flying conditions.

* * *

The Australian Government has appointed Mr. Hudson Fysh managing director and chairman of directors of Qantas Empire Airways. Sir Keith Smith and Mr. W. Taylor are co-directors. Sir Fergus McMaster was chairman of Q.E.A. from the time it was formed, in 1920, until the Government took control of the company.

* * *

A special freight service will shortly be introduced by B.E.A. from Manchester to London and the Continent, with Dakota freighters. The actual route will be from Manchester, through London to Brussels and Prague, and will link up at Northolt with services to other parts of the Continent.

The Parliamentary Secretary to the Ministry of Civil Aviation announced in the House last week that as from April 1st the three Corporations had been instructed to treat Government departments in the same way as private passengers, with regard to the cancellation of bookings which had been made in the names of individual civil servants or other persons whose travelling expenses were charged to public funds.

* * *

Passenger traffic in the English Division of B.E.A. showed an increase again for May and June this year. During May 22,068 passengers were carried, and during June 28,849. During May, airports in the Division's area handled 38,933 passengers, and during June 57,400 passengers.

* * *

The Minister of Civil Aviation has appointed Mr. R. M. Campbell, a consulting engineer, and Mr. J. L. Gleave, an architect, to the Scottish Aerodromes Board, with the object of strengthening it on the technical side. The remaining members of the Board are A. Cdre. J. L. Murray, Sir Patrick Dollan and Sir William Thomson.

FROM THE CLUBS

The official opening of the Bridlington airfield and the East Riding Flying Club by the Mayor of Bridlington is due to take place to-day, August 14th. The club, which has been operating since July, 1946, has a membership of 120 and a fleet of five Austers and one Tiger Moth.

* * *

The air display which the Midland Aero Club had hoped to hold on Saturday, August 16th, has been unavoidably cancelled. However, the club is holding an informal "At Home" on this date, and visitors will be very welcome. The proceedings will start with an arrival competition open between 1 p.m. and 2 p.m., and there will be various competitions, including a "navigation exercise."

* * *

Aircraft of the Reading Aero Club were kept busy over the August Bank Holiday flying members to various coastal and other resorts. Two "A" Licences have recently been obtained through the club, and a tentative booking has been arranged for aircraft to fly to the Belgian Congo for the International Air Rally to be held there at the end of October.

* * *

A tea-fight has been arranged to take place at the Redhill Flying Club on Sunday, August 17th. Flying clubs are challenged to "attack" Redhill between the hours of 3.45 p.m. and 4.15 p.m., flying in at a height of between 1,000 and 2,000ft. Aircraft of the Redhill club will patrol a radius of not more than 5 miles from the centre of Redhill airfield, and a free tea and lots of fun await the "raiders" who penetrate the "defences" without having their registration letters taken. Left-hand circuits must be observed. All parts of the airfield, which is 2 miles south-east of Redhill, are in use, with the exception of the south-western corner, which is clearly marked with the usual signals.

* * *

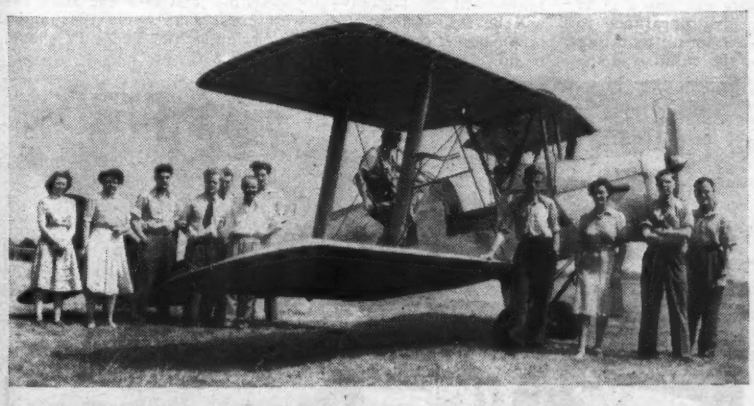
At Sherburn-in-Elmet, home of the Yorkshire Aeroplane Club, four recent first soloists have now passed their "A" Licence examinations. On July 12th, sixteen club members flew to France to attend the Deauville Rally, and all paid tribute to the efficient organization and to the wonderful hospitality extended to them. The social committee of the club has organized a club week-end rally to the Isle of Wight to take place on September 6th-7th.

* * *

An average of eighteen members a week is the record of the Plymouth and District Aero Club, the membership of which has now reached 285. The club has hopes that the portion of its clubhouse which is at present in use by the R.A.F. will be returned before the end of the summer. Eight members of the club recently made their first solo flights, two have obtained their "A" licences, and three have passed the "A" licence flying tests. Three pre-war "A" licences have also been renewed. The club fleet consists of two Autocrats, one Tiger and one Fairchild Argus. During June each aircraft averaged 48 hours' flying, a record for the club, and this figure was well exceeded during the month of July.

* * *

The Ministry of Civil Aviation has granted permission for the Darlington and District Aero Club to maintain club premises and facilities at Croft Airport, near Darlington. This new club commenced activities on August 2nd, and on August 4th the club was officially inaugurated by the Mayor of Darlington, Councillor A. J. Alsop. A programme of flying competitions had been arranged, but it was curtailed by bad weather, but, despite this, all ten of the club's aircraft became airborne during the afternoon, and in one of them F/L. G. Unwin gave a display of aerobatics. A. E. Coltman, of the Leicester Flying Club, took first prize in the arrival competition. The club already has 100 members.



SPARE-TIME BANKING: Members of the Midland Bank Flying Club beside one of their Tiger Moth aircraft at Fair Oaks airfield, near Woking. The club has financial backing from the Midland Bank and since the war 45 members have been granted "A" licences.

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TUDOR NEWS

ON the evening of Thursday, August 7th, the experimental Avro Tudor VII visited the London Airport to give a demonstration flight. This aircraft is experimental only in having Bristol Hercules 120 engines in place of the normal Rolls-Royce Merlins; in all other essentials it is a Tudor II. The purpose of fitting Hercules engines is to provide a little more power for take-off, and when the latest mark of Hercules, the 763, is fitted the present 1,715 h.p. per engine will be increased to over 2,000 h.p. for take-off. Both are two-speed engines, the present 120 being rated at 6,000 and 23,000ft according to gear.

When the fitting of radial engines to the Tudor was first discussed, it was suggested that the alleged swing on take-off, which had been the subject of a good deal of discussion at the time, might be improved by having airscrews rotated in the opposite direction to the Merlins, and having what was called a symmetrical thrust line, i.e., with the airscrew and spinner in the middle of a circular engine cowling. It now seems that these theoretical considerations had no effect.

So far as A. V. Roe's experience is concerned, the Tudors do not have any marked tendency to swing and certainly do not swing more than other large tail-wheel aircraft. On the test flight from Heathrow the first pilot, Mr. J. H. Orrell, who is Avro's assistant chief test pilot, opened all four throttles to the stops very early in the take-off run and maintained direction on the rudders without any difficulty at all. He pointed out that it was normal practice on all Tudors for the throttles to be wide open on take-off by the time 50 m.p.h. was indicated. The take-off weight at Heathrow was about 72,000 lb, or 8,000 lb under the maximum load.

Demonstration at Heathrow

In a forty-minute flight from Heathrow Mr. Orrell and his second pilot, Mr. Kenneth Cook, took the Tudor to the south coast, circling Brighton before return. They flew at about 2,500ft, just under a layer of cumulus cloud, and as a result the air was fairly rough. Except, however, for a slight shimmying, similar to the yawing motion in a railway carriage, noticeable chiefly at the nose and tail of the aircraft, and attributed to flexing of the long fuselage in bumps, the Tudor VII was very steady. The silencing is particularly good, and normal conversation can be carried on anywhere in the aircraft. It is probably the quietest of all the large aircraft operating or demonstrated over this country. It is possible to feel a slight vibration through the floor when walking up and down the fuselage, but this is certainly not excessive. The crew quarters are above average in spaciousness and layout, and the pilots' cockpit, which contains only the bare essentials of instruments and controls, is exemplary.

The furnishing of the interior, which is fully fitted out with seats, bunks and bar, is pleasing and quite luxurious. The colour scheme is in dark blue with light buff walls and ceiling. The spacious compartment in the vicinity of the bar and rear entrance was much appreciated, and the large windows give a very good view of the countryside below. The adjustable metal lamps on the backs of the seats are not a good feature, in that they help to give an untidy appearance to the cabins, and several of them are responsible for an irritating rattle. One of the main noises audible in the cabin was the whistling and rushing of air around the rear entrance door.

On return to Heathrow the Tudor made an excellent landing, touching-down at about 80 kt. The speed at about 2,500ft was 170 kt, indicated, with 33in of boost and 2,000 r.p.m.

This Tudor VII was produced, or more correctly, converted, to the order of the Ministry of Supply, but no orders have yet been placed. So far as the manufacturers are concerned it is simply a case of the customer ordering a Tudor II with the engines—Merlin or Hercules—which he prefers. Should he take four Hercules 763 engines, the take-off will be improved, the fuel consumption might work out slightly better at the present time, he would lost approximately 700 lb payload (the radial installations weighing just under 200 lb more), and the price would be a little higher. Speed and economy of operation depend upon operational height, but the exhaust noise from the Hercules would be less than from the Merlins.

The Tudor VII first flew on April 17th of this year and has done a little over 30 hours' flying to date.

Incidentally, the modified and re-tested Tudor I is due to go to Boscombe Down towards the end of this month.

The figures given for the Tudor VII with Hercules 120s are as follows; Still-air range, 2,800 miles at 10,000ft at 200 m.p.h. with full tanks (2,340 gallons); max. speed, 320 m.p.h. at 6,000ft; cruising speed at 70 per cent take-off power, 270 m.p.h. at 10,000ft.

The Tudor VII, a Mk. II fitted with Hercules engines has improved take-off performance and is noticeably quieter in the cabin.

B.S.A.A. TUDOR TESTS

FURTHER details are now available of the results obtained during the recent trials of the Tudor IV in the West Indies. British South American Airways undertook the tests, which were part of the requirements of the A.R.B. for a certificate of airworthiness on aircraft to be operated in tropical climates, and A.V-M. Bennet led the team of fifteen representatives from the M.C.A., the Corporation, Avro, Rolls-Royce, and the A.R.B. The outward flight was made across the North Atlantic owing to poor weather at the Azores, and the journey from Prestwick to Gander took 11¼ hours. From Gander the Tudor IV was taken to Bermuda, through the Port of Spain to Kingston, Jamaica, where most of the trials were carried out. Water ballast tanks had been fitted and take-off tests were made at the all-up weight of 80,000lb. We understand that there was no pronounced swing at any time, nor was there any sign of buffeting at speeds much above the stall, and the crew were satisfied that without any major modifications the type may be put into service without delay.

There were minor defects which were mostly connected with the unusual equipment with which the aircraft had been fitted for the tests, resulting in poor air distribution and a higher noise level factor. On the ground it was found that some form of air conditioning would be necessary in the hot climates, and efforts are being made to organize a portable refrigerating unit at all stops on the route. The pressurization system was satisfactory for the few hours it was tried, but there again, full pressurization could not be maintained owing to the extraneous equipment and the difficulty of completely sealing the fuselage.

At the maximum take-off weight of 80,000lb, thirty-two passengers, 3,000lb of freight and 3,300 gallons of fuel can be carried, giving an extreme range of 3,250 nautical miles. Tests showed that at a cruising speed of 219 knots, flying at about 10,000-12,000ft, and using 41 per cent M.E.T.O. power, the fuel consumption was 0.985 nautical miles per gallon. The take-off runs were found to be about 1,150 yards and the landing runs about 1,000 yards, in calm conditions, at maximum take-off and landing weights.

B.S.A.A. have eight captains partially trained on Tudors, and the Corporation plans to fly, first of all, one flight on the east coast route as a dress rehearsal, carrying passengers. Four of the type are on order, three of which have been promised for the end of September. They will be flown on the east coast route until the Tudor Vs are available, and then the Mark IVs will be transferred to the west coast route. On the longest ocean hop, from the Azores to Bermuda, the Tudor IV should be flown at almost full capacity load with safety.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

OFFICERING THE A.T.C.

The Right Men for the Right Job

I SHOULD very much like to shake hands with Leslie W. Crawford after reading his letter in *Flight* of July 17th. After my own experience both with the A.D.C.C. and A.T.C., I think it is time the Air Ministry started a sort-out of these so-called officers. I think that the local Committee is largely to blame when someone who has, like myself, devoted all his spare time to courses, week-end gliding and instructional work finds other officers with very little interest getting all the credit, in some cases because they have a good position outside the A.T.C.

I can recall an instance when a man was sent to the Air Ministry for an officers' selection board. Needless to say, he was turned down, but with the aid of the local Committee he was given another chance. This time the man was commissioned in the A.T.C. and later became C.O. of the Squadron. In time the Squadron fell way to a bare minimum, but this same man was then given another Squadron, and the same thing happened again. Surely this sort of thing discourages any officer who has any sense of fairness to the boys.

Shortly after this incident I sent my resignation to the Committee and waited for confirmation from the A.M. After two months' waiting, I found that the Committee had not forwarded my resignation. I think it is time that A.T.C. Squadrons did away with these Committees and were officially taken over by the Air Ministry.

E. MORRISON,
Late F/O., Dagenham.

THRUST-BOOSTING OF JET ENGINES

Some Sensational British Results with Ammonia

(From Air Commodore F. Whittle, C.B., C.B.E., F.R.S.)

READERS of recent issues of *Flight* may well have received the impression that the Americans were the first to apply coolant injection as a method of thrust-boosting jet engines. The fact is that our experiments in this direction started in 1941, and information on the subject formed part of the steady stream which flowed across the Atlantic from October, 1941, onwards.

As in most other aspects of jet-engine development, Power Jets were the pioneers. In 1941 Power Jets examined the possibilities of many coolants, including ammonia, water, liquid oxygen, alcohol and other volatile hydrocarbons, and settled on ammonia for initial experiments. Water and water-methanol were tried later, both by Power Jets and the other firms engaged. We started with ammonia because its low boiling point and very high latent heat of evaporation (which is, I believe, second only to water) seemed to make it the most powerful coolant available in reasonable quantities. In dry air it is very effective, but if the humidity is high its great affinity for water, and its high heat of solution, offsets a considerable proportion of the effect.

The first time we used it the results were sensational. Ammonia is a fuel, and we therefore warned the operator at the controls that a considerable closing of the fuel throttle would be necessary as soon as the ammonia was turned on, to avoid overspeeding the engine (a governor was not fitted at the time). The engine was the W1, designed for 1,240 lb thrust at 17,750 r.p.m. The large bottle of liquid ammonia was situated outside the test house, and so the operator on the engine control had to rely on hand signals from another test hand who was in a position to observe a third operating the cock of the bottle. The hand signal was given when No. 3 started to open the cock, but it stuck and he did not succeed in opening it for some few seconds.

In the meantime the operator of the engine control had relaxed, believing that the ammonia was already "on." When it did come on, those in the vicinity thought there had been an explosion in the test house, so sudden and violent was the increase of power. The tachometer went off the end of the scale (20,000 r.p.m.) and so did the thrust balance (2,000 lb) and the mercury was blown out of all the manometers indicating compressor delivery pressure, etc. Fortunately the engine did not scatter itself over the countryside, as we would have expected, but it must have been very near doing so as all the turbine blades were found to have stretched to the point of taking up all the tip clearance.

We prepared a scheme for applying ammonia injection in the Gloster-Whittle E28 but it was never actually tried.

In the earlier experiments we injected the ammonia into the venturi inlet duct to the otherwise hermetically sealed test house, but later we used a series of atomizing nozzles, distributed round the blower intakes. The earlier method produced such a dense fog in the test house, due to condensation, that nothing could be seen through the observation window.

So far as I know, coolant injection has not been tried in flight in this country, and so the Americans can claim to be first to use it in flight.

Many experiments have also been made with thrust-boosting by burning extra fuel in the jet pipe. This had been suggested by the Engine Section of the R.A.E. as early as 1939, if not before, and it was the Pyestock section of the R.A.E. Engine Department which made the first experiments. These experiments were continued by Power Jets (R. & D.), Ltd., (in which the personnel of the old Power Jets and Pyestock was amalgamated) and applied in flight. It was found possible to increase the speed of the Meteor I (powered by Power Jets W2/700 engines) by 30-40 m.p.h.

FRANK WHITTLE.

ELEMENTARY TRAINERS

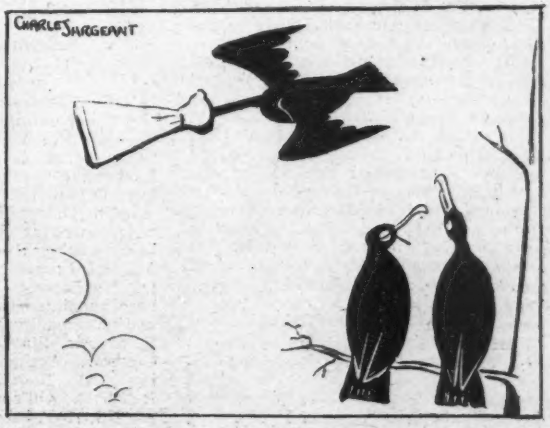
The Question of Seat Arrangement

I REMEMBER several years ago you published an article in which among other things was discussed the relative merits of side-by-side and tandem seating for training aircraft. I believe the opinion was in favour of the former arrangement, and with this I agree. The pupil can certainly blush and dither in private if he sits behind in a separate cockpit, but without having very strong feelings on the subject, most people now seem to prefer side-by side seats. Even so, the Tiger Moth, which has been "shortly to be superseded by a later type" for the last five or more years to my knowledge, is still the standard trainer in this country, and it still maintains its excellent reputation.

As a result of much high-level consultation (I understand) an entirely new type of trainer with a large cabin and more than two seats is soon to be introduced, and I have been trying to find a club or Service instructor who knows what considerations led up to this specification, or one who thinks it is a good idea to increase the responsibilities and difficulties of a first soloist by sitting him in a comparatively large and unwieldy machine.

Rightly or wrongly, I would personally like to see a direct descendant of the Tiger line replace this old faithful in club and school, and without forgetting my original remarks on seating arrangements, I believe the Chipmunk would be one machine that would be welcomed by many people.

ONE-TIME A.2.



"I.F."

SERVICE AVIATION

'TWIXT CRUISER AND CARRIER: Fairey Firefly I fighter-reconnaissance two-seaters of the Royal Canadian Navy pass low between their parent carrier and the escorting cruiser.

R.A.F. Appointments

THE Air Ministry announces the following Royal Air Force appointments:—

Air Vice-Marshal Thomas Audley Langford-Sainsbury, C.B., O.B.E., D.F.C., A.F.C., to be Air Officer in Charge of Administration at Headquarters of British Air Forces of Occupation, Germany.

Air Vice-Marshal Francis John Williamson Mellersh, C.B.E., A.F.C., to be Air Officer Commanding, No. 21 Group, Flying Training Command.

Air Vice-Marshal Langford-Sainsbury has been Senior Air Staff Officer, Bomber Command, since May, 1945, and was formerly Air Officer Commanding, Air Headquarters, Egypt, where he went in October, 1944, after having been Air Officer Commanding, Eastern Mediterranean. Previously he was Air Officer in Charge of Administration, No. 201 Group, Middle East, from March, 1943. Towards the end of 1942 he became A.O.C., No. 15 Group, and formerly was Deputy Senior Air Staff Officer at the Headquarters of Coastal Command.

Air Vice-Marshal Mellersh has been Air Officer Commanding No. 91 (Bomber) Group, since October, 1946, and was formerly Commandant of the R.A.F. Staff College (Allied Wing) from July, 1945. Previously he was A.O.C. No. 231 Group, Air Command, South-East Asia, to which he went in January, 1944, after a short period on Air Staff planning duties at H.Q., A.C.S.E.A. Earlier in 1943 he was Senior Air Staff Officer at A.H.Q., Bengal, and he formerly held a similar post at No. 222 Group, H.Q.

A.A.F. Appointment

THE Air Ministry announces the following Auxiliary Air Force appointment:—

Squadron Leader Robert James Walker, D.S.O., to command No. 605 (County of Warwick) Squadron, A.A.F.

S/L. Walker joined the R.A.F. as a pupil pilot in 1937 and was granted a short-service commission for four years. On flying duties at the outbreak of war, in August, 1940, he became an instructor at an operational training unit, and except for a few brief interruptions remained on flying training duties until going overseas in February, 1942. He commanded several squadrons in turn in India and in Air Command, South-East Asia. He won the D.S.O. for his "fine example of courage and determination in the face of much physical distress," when he was cut about the eyes and temporarily blinded while attacking an important bridge in Burma in March, 1945. At that time he was commanding No. 45 Squadron, A.C.S.E.A.

Royal Air Force and Naval Aviation News and Announcements

Command of R.N.V.R. Squadrons

THE appointments are announced of Commanding Officers for three of the four R.N.V.R. Air Squadrons now being formed in the United Kingdom. Lieutenant Commander (A) Paul Godfrey, O.B.E., R.N.V.R., becomes Commanding Officer of Fighter Squadron No. 1832, based at R.N. Air Station, Culham, serving the London-Oxford area. Acting Lieutenant Commander (A) James D. Murricane, D.S.C., R.N.V.R. has been appointed to the Fighter-Anti-Submarine Squadron No. 1830, based at R.N. Air Station, Abbotsinch, near Glasgow. Acting Lieutenant Commanding (A) N. G. Mitchell, D.S.C., R.N.V.R., will command Fighter Squadron No. 1831, based at R.N. Air Station, Stretton, near Liverpool. The appointment of a Commanding Officer for No. 1833 Fighter Squadron, to be based on the R.N. Air Station, Bramcote, has not yet been made.

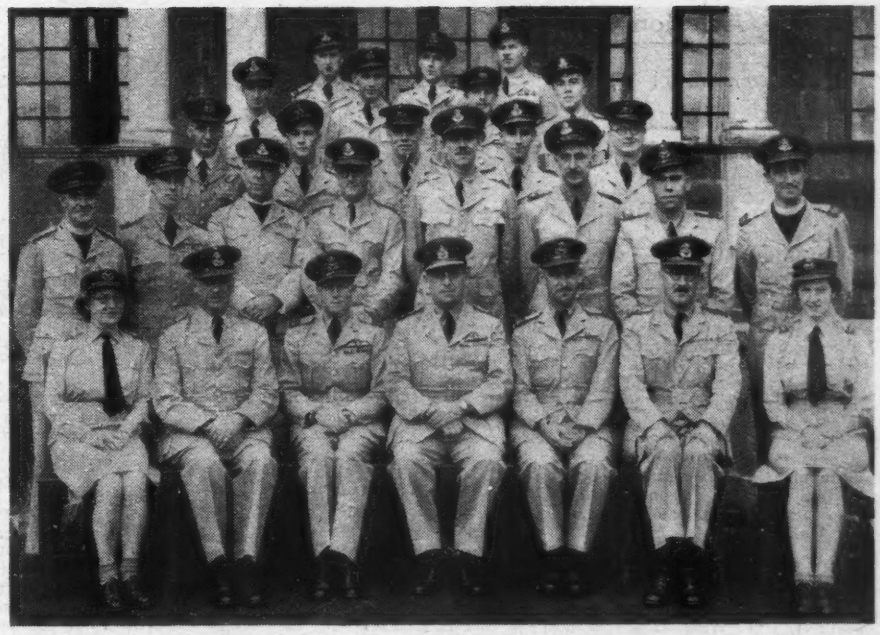
Lt. Cdr. Godfrey commanded the first Fulmar squadron attached to H.M.S. *Illustrious* during the war and is a member of a flying family. His father held a flying licence at the age of 80. During his service Lt. Cdr. Godfrey failed to locate the carrier while on patrol in the Mediterranean and was forced to land in Crete. In reply to a long speech of welcome he said: "When I was in the sky the choice was between Heaven and Crete. I chose Crete." Later he was interned in Greece, but when the Greeks came into the war he was sent back to Crete and with the aid of two Greeks he repaired his damaged aircraft and operated it as the sole fighter defence of Crete at that time. Ultimately he reached Alexandria and rejoined his ship. During operations in Madagascar he was shot down but rejoined his squadron after walking 17 miles and passing through the French lines. After returning to Britain he was lent to an R.A.F. Spitfire squadron for close escort bomber duties over France and he received the O.B.E. for distinguished services.

Acting Lt. Cdr. Murricane, who is to command 1830 Squadron, carried out bomber operations in Albacores over the Western Desert during the war and was awarded the D.S.C. for distinguished services in the Mediterranean theatre. Once he engaged three Fw 190s in daylight and reported "aircraft suffered 300 plus holes—self none."

Acting Lt. Cdr. Mitchell, 1931 Squadron, won his D.S.C. for gallantry, skill and devotion during operations over Jap islands. Serving in a squadron from H.M.S. *Indomitable* he took part in strikes against Sumatra, and during the latter days of the war in the Pacific, against many islands from which the Japanese were attempting to ferry aircraft to reinforce Okinawa.

New Director of Studies

MR. PATRICK JOHNSON, O.B.E., M.A., lately Vice-President Magdalen College, Oxford, has been appointed Director of Studies at the Royal Air Force College, Cranwell. Mr. Johnson, who is 43, was educated at the R.N. College, Dartmouth, and Tonbridge School, and at Magdalen College, where he was a Fellow and Lecturer in Physics from 1928 until last month. Mr. Johnson rowed for Oxford against Cambridge in 1927, and was a member of the Oxford University Air Squadron. During the recent war he served in the Army and commanded an Operational Research Section in 21 Army Group with the rank of Lieutenant-Colonel. He was mentioned in despatches, and was awarded the O.B.E. in 1945.



AIR HEADQUARTERS, EAST AFRICA: A recent group at A.H.Q. East Africa: (Back row) F/L. Cave, F/L. Chapman, F/O. Katic, (4th row) F/O. Clark, F/L. Higham, F/L. Martin, F/L. Edwards, (3rd row) F/L. Mason, F/O. Kay, S/L. Plested, F/L. Dunn, S/L. Stewart, (2nd row) S/L. Dullehan, S/L. Ball, S/L. Baker, S/L. Dellbridge, S/L. Findlay, S/L. Preston, S/L. Down, S/L. Wittington, (front row) Flt/O. Beer, W/C. Broad, W/C. W. A. Richardson, (Sen. Air Officer), A/Cdr. N. A. P. Pritchett (Air Officer Commanding), W/C. F. C. Richardson, (Staff Off. Admin.), W/C. Blair, Flt/O. Ralli.

C.A.S. and General Spaatz Exchange Messages

ON the occasion of the United States Army Air Force Day (August 1st) the Chief of Air Staff, Marshal of the Royal Air Force Lord Tedder, sent the following message to General Spaatz, Commanding General United States Air Force:—

"On Air Force Day, 1947, the Royal Air Force send the United States Air Force their warmest congratulations. This great anniversary, which symbolizes so much inspiring tradition and achievement, strikes a chord in all our hearts and makes us more than ever proud of the many joint endeavours in which we have been associated with United States comrades. The Royal Air Force is greatly honoured and delighted that you have invited our No. 617 Squadron to represent us among you on this great day and they bring with them the heartful good wishes of us all."

General Spaatz replied to Lord Tedder as follows:—

"On behalf of the Army Air Forces I thank you and the Royal Air Force for your message congratulating us upon the occasion of the fortieth anniversary of our founding. We are particularly pleased that the Royal Air Force should be represented among us at this time by your No. 617 Squadron which so well symbolizes the achievements of your splendid organization. As the Army Air Force prepares to assume a new rôle in the new national military establishment of this country and reviews its past achievements it is grateful for the congratulations, the friendship, and the good wishes of the Royal Air Force."

R.A.F. Regiment, Malaya

THE formation of the R.A.F. Regiment, Malaya, under consideration for some time past, has now been approved by the Air Ministry, and recruiting will begin on August 25th when the present Muslim month of fasting has ended. This was announced by Air Vice-Marshal J. D. Breakey, C.B., D.F.C., Air Officer Commanding Malay, recently.

Owing to administrative difficulties and shortage of accommodation enlistment will be restricted at first to Malays between the ages of 18 and 30 years, but consideration may be given later, said Air Marshal Breakey, to accepting recruits of other nationalities. The Regiment—which is to be equipped with the most modern weapons—will consist of a Regiment H.Q., a training depot and five squadrons, and its strength will total 1,000 men. It will undertake the protection of airfields as part of the local defence scheme for Malaya, and is liable for service in Sarawak, Brunei and North Borneo, as well as Malaya and Singapore. In times of Empire emergency, it will be liable for service in any part of the world.

Brigand Data

IN addition to the Brigand T.F.1 now going into service with the R.A.F., a special meteorological version of the Brigand has been developed under the designation Brigand Met. III. Like the torpedo fighter version, the "Met. III" is fitted with two Bristol Centaurus 57 sleeve valve engines which, with methanol water injection, deliver no less than 5,640 h.p. for take-off. The span and length of the two versions are identical (72ft 4in and 46ft 5in respectively), and each carries a crew of three. Weights, however, differ. Whereas the torpedo fighter has a tare weight of 25,345 lb, the met. machine weighs 23,750 lb. The maximum gross weights are 33,850 lb and 39,000 lb respectively, but the torpedo fighter is cleared for an overload weight of 41,000 lb. Due to the fact that it is lighter and carries no armament, the meteorological type is the faster, with a speed of 365 m.p.h. at 15,000ft; the corresponding figure for the T.F.1 is 345 m.p.h. at 14,000ft. The Brigand Met. III is superior also in having an initial rate of climb of 1,920ft/min and a service ceiling of 30,000ft, the corresponding figures for the F.T.1 being 1,490ft/min and 26,000ft. Cruising at 195 m.p.h. at 10,000ft and carrying a war load of 5,409 lb and 1,058 gallons of fuel, the T.F.1 has a combat radius of 1,040 miles. At 186 m.p.h., with the same fuel tankage but without war load, the meteorological machine has an operational radius of 1,185 miles.

The latest data relative to the T.F.1 show that, as an alternative to an 18in Mark XVII torpedo, it will take two 1,000-lb bombs under the fuselage in addition to two 600-lb bombs under the wings. Various combinations of R/Ps may alternatively be carried. In any operating condition the built-in forward-firing armament of four 20 mm Hispanos and one 0.5in Browning is retained.

Bomber Command Gift

BOMBER COMMAND'S appeal to all ranks for donations in aid of victims of recent floods resulted in £2,526 being raised. Three-fifths of the total has been sent to the Lord Mayor of London's National Flood Distress Fund, and has been earmarked for assistance to the hard-hit areas of Gainsborough, Lincoln, Doncaster, Huntingdon and Ely—areas with which the Command had close ties during the war. The remaining two-fifths has been sent to the National Farmers' Union Agricultural Disaster Fund.

Service Aviation . . . . .

Lincolnian for U.S.A.

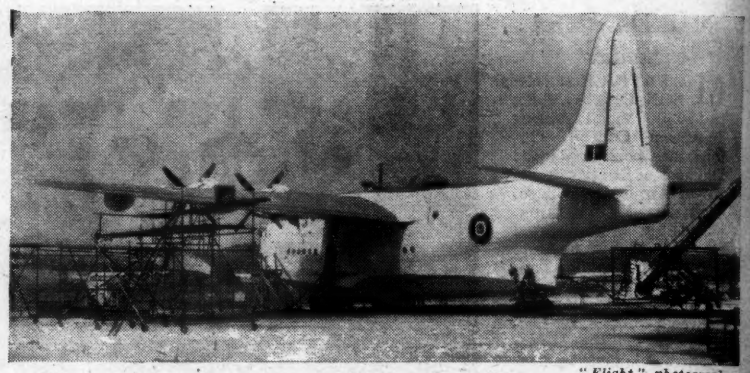
ANOTHER liaison mission from the Empire Air Navigation School at Shawbury, flying in the Lincolnian aircraft *Aries II*, is visiting Canada and the United States this month and will remain in America until nearly the middle of September. The aircraft, a modified Lincoln and the first to be given the name Lincolnian, left Prestwick on August 11th and flew direct to Montreal. A. Cdre. N. H. D'Aeth, C.B.E., commandant of the school, is captain of the aircraft and officer commanding the mission. The other crew members are S/L. R. G. Churcher, D.S.O., D.F.C., 1st pilot; S/L. E. J. Penikett, 2nd pilot; S/L. J. L. Pepperman, 1st navigator and deputy flight commander; S/L. D. P. Morrison, 2nd navigator; F/L. G. R. Arney, set operator; and F/O. T. H. Graham, wireless operator. G/C. C. E. Chilton, C.B.E., Deputy Director of Navigation, accompanies the mission as Air Ministry representative.

King's Prize Winner in Sweden

WINNERS of the King's Prize at Bisley, W/O. R. Bennett (1947) and S/L. C. C. Willot (1946), both of the R.A.F. have flown to Stockholm as members of the combined British Services team to compete in the world shooting championships. Other R.A.F. members of the combined Services team are A. Cdre. W. F. E. Staton, Vice-Chairman of the R.A.F. Small Arms Association, W/C. J. K. Gallie, S/L. A. J. Whiting, S/L. C. J. Collins and F/L. A. J. Steele, A.F.C.

Search Teams in Burma

FIVE R.A.F. search teams, each consisting of an officer, a senior N.C.O. and an airman driver, equipped with a jeep and trailer, have toured Burma for fifteen months to try to discover the fate of airmen reported missing during the war. The search has been going on continuously from early 1946, except for interruptions during the monsoon period last year, until the beginning of the present monsoon.



"Flight" photograph

SEAFORD I: A Short Seaford I long-range reconnaissance flying boat on the Short Bros. slipway at Rochester. The Seaford has Bristol Hercules XIX. engines, which give a top speed of 240 m.p.h. It is the military counterpart of the Solent.

S.R./A1—Drop Tanks

TWO welded magnesium drop tanks, each of 141 gallons capacity, can be fitted under the wings of the Saunders-Roe S.R./A1 jet fighter flying boat.

Territorial Parachute Training

MEMBERS of the 16th Airborne Division, Territorial Army, have been in camp at Upper Heyford, where they have been taking a course of ground and air instruction. A special course has been held for Territorial officers lacking previous experience.

Route Inspection

AIR MARSHAL SIR RALPH COCHRANE, A.O.C.-in-C., of R.A.F. Transport Command, has arrived in Singapore to discuss the trunk air route organization of the R.A.F and other common air transport problems. The York which brought him from Negombo, Ceylon, also carried Mr. F. H. Sandford, the Deputy Under-Secretary of State for Air. On arrival they were met at the airfield by the Station Commander, G/C. F. G. Cator, the Air Commander-in-Chief, Far East, Air Marshal Sir George Pirie, and the A.O.C., Malaya, A.V-M. J. D. Breakey.

The "American Farmer"

OF awards totalling £23,045 made in the *American Farmer* salvage action, the Air Council and the eight members of the crew of a Coastal Command Liberator are apportioned £4,050, including expenses agreed at £2,856. Decision has not yet been reached as to whether the money will be divided among the Liberator's crew or donated to the R.A.F. Benevolent Fund.

Biggin Hill Pilots' Chapel

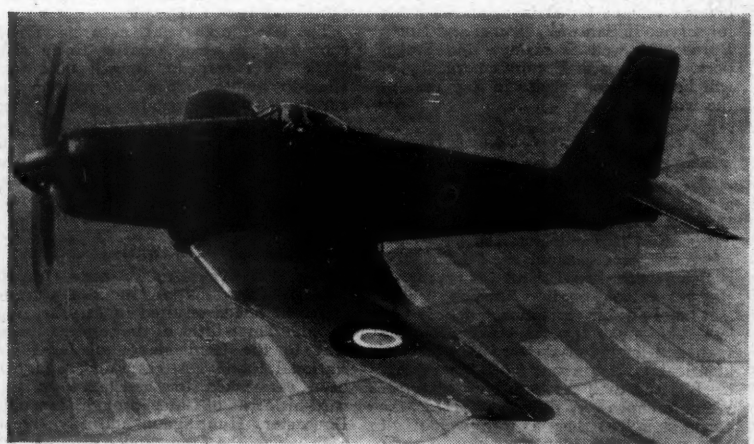
FOLLOWING an Air Council decision to restore St. George's Chapel of Remembrance at R.A.F. Biggin Hill, the Memorial Committee has issued an illustrated booklet giving details of the scheme and depicting the design. Mr. Churchill has written a personal commendation of the appeal, which is being privately circulated among relatives of pilots commemorated and friends of Biggin Hill. The architect is Mr. W. Wylton Todd, A.R.I.B.A., formerly a Flight Lieutenant in the R.A.F. The Memorial Committee is anxious that those interested in the project who were either stationed at Biggin Hill or at other stations in the Biggin Hill Sector shall know of the scheme. A copy of the booklet will be sent free on application to the Secretary, Biggin Hill Memorial Committee, R.A.F., Uxbridge, Middlesex

Britannia Shield Competition

THE United States and Greece have now accepted the invitation to enter teams for the Britannia Shield Competition to be held in this country during Battle of Britain Week (September 15th-21st). The contest is restricted to sportsmen in the armed forces of nations who took part in the Battle of Britain or were assembled on British soil between 1940 and 1945. Czechoslovakia won the shield last year and is entering again; other nations taking part include Belgium, France, the Netherlands, Norway and Great Britain

Reunion

THE first annual dinner of the R.A.F. Education Branch will be held in London on September 30th. Admission by ticket only, obtainable from the Dinner Secretary, Room 338, Alexandra House, Kingsway, W.C.2.



"Flight" photograph

FOR OFFICIAL STRIKES: The new Blackburn Y.A.1 single-seat naval strike aircraft (Bristol Centaurus) which is unofficially known as the Firecrest. This new view shows the first prototype while on test, piloted by Mr. P. G. Lawrence.